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The Sewerage of Algiers. By M. PIARRON DE MONDESIR, Eng. (*des Ponts et Chaussées.*)

INTRODUCTION.

In presenting a description of the drainage works of Algiers for publication in the "*Annales des Ponts et Chaussées,*" I thought it might be favorably received by the administration of Public Works, who cannot fail to take a lively interest in the work done in Algiers by the engineers whom they have sent to this colony.

I supposed, moreover, that this account might be read with some interest by the Engineers of the Corps, not so much on account of the importance of the works, (for France, and Paris especially, has the same kind on a much larger scale,) as that they were executed in a country but little known, and upon whose progress France keeps a watchful eye.

Alignement.—The sewerage of the enclosure of Algiers was designed and executed principally for the purpose of freeing the harbor from the foul products of the drains of the city. A summit level canal is substituted for the ancient canals, which, lying perpendicular to the shore, and emptying directly into the harbor, occasioned more or less injury; while it answers as a substitute, it, at the same time, insures a healthful condition of the city.

On an inspection of the Plan of Algiers, (Pl. I, Fig. 1.) it will be

seen that a surface of 360·6 acres, comprised between the new fortifications, is composed of two principal basins separated by the line A B C, to wit:

Basin north of summit ridge, A B C, whose sewers discharge outside of the harbor, . . .	103·7 acres.
The south basin, whose sewers emptied directly into the harbor before the construction of the canal, . .	256·9 "
Total,	360·6 "

The harbor receives also the products of the outer basin of the Tivoli Ravine, which passes under the fortification, and traverses the Faubourg Bab-Azoun; the surface of this outer basin is 54·3 acres.

The main object was to free the harbor from the products of a total surface of 311·2 acres, and to attain this end, three principal branches were designed and executed; these combined, constitute the drainage of the enclosure of Algiers.

These three branches have their origin at the government square. The first, that of the Marine, follows the street bearing its name throughout its length, passes under the gate of France, and empties outside the harbor, west of the Jetty Cheriddin.

The second, that of Bab-el-Oued, follows the street of its name throughout its length, and empties into the sea back of "Fort Neuf" to the west of the Marine Branch, and, consequently, outside the harbor.

The third, that of Bab-Azoun, follows, throughout their length, the streets Bab-Azoun, and of the Faubourg Bab-Azoun, and discharges into the sea outside the South Jetty now in construction.

The length of these three branches, is

Branch of the Marine, . . .	1033 feet.
" " Bab-el-Oued, . .	1945 "
" " Bab-Azoun, . . .	4944 "
Total,	7922 "

The basin of the Marine Branch comprises an area of .	14·8 acres.
That of the branch Bab-el-Oued, " " . .	83·9 "
" " Bab-Azoun, " " .	279·1 "
Total,	377·8 "

At the present time there remains but a surface of 37 acres, whose product is delivered directly outside of the harbor. The product of 69 acres is now delivered into the branch Bab-el-Oued.

It is apparent that the branch Bab-Azoun is, by far, the most important in respect to its length and extent of basin.

Sewerage established according to the Free System.

Before continuing this description, it is proper to state, that the sewerage of Algiers is designed, as those of London and other cities in England, to carry away, not only the rain and house waters, but also all the stercoraceous matter of the city, and it is, moreover, to have placed within the galleries, upon cast iron brackets, pipes for the distribution of the water to the lower parts of the city. These dispositions

contemplated in the project have occasioned objections on the part of the General Council of "Ponts et Chaussées."

Discussion of the "Free System."

Questions bearing closely upon the public health, afford a peculiar interest, and I thought it would be well to present a summary of the objections made by the Council General of "Ponts et Chaussées," and to state the reasons which determined the War Department to uphold the intention of the project.

The Council General of "Ponts et Chaussées" have declared against a system which involves the reception of stercoraceous matter into the public sewers, a system which we shall hereafter briefly designate as the free system. Its inconveniences were pointed out in the report of M. Inspector Darcy,* the main features of which were

On the one hand, that it occasions deleterious effluvia, existing constantly in the sewers, which escape through the water inlets, and some of the pipes, and so compromise the public health; and, on the other hand, it is held to be a voluntary deprivation of a source of very precious compost.

In support of this opinion the report cites the inconvenience experienced in London, Brussels, and Liege, and the opinions of divers English and Belgian engineers upon this subject.

The General Council would not approve of placing conduit pipes in the interior of a sewer established under such conditions, that is to say, *in a canal designed to become the general privy of the city of Algiers, a hot-bed of infection which could not be traversed without danger.*

He concludes that none but the rain and house waters should be admitted into the sewers, and that the perfected processes for clearing night soil, practised in Paris, should be applied to Algiers. This, it appears, was to place the city of Algiers in the condition of Paris, and other great cities of France, in the matter of sanatory works.

Not only would these novel dispositions change the whole economy of the projects of the sewerage, but their application would have completely destroyed the usages which existed in Algiers long before the conquest. In fact, excepting some new streets of the Faubourg Bab-Azoun, every street and every alley is furnished with a public sewer, which receives the night soil of the neighboring houses. The prohibition of the entry of these matters, is the prohibition of any sewer in the city, since the sewer of the enclosures receives nearly all of them.

It would then be necessary to construct vaults under all the houses, and to prevent their communication with the public sewer.

Without speaking of the administrative and practical difficulties attending the application of this measure, it might be reasonably objected that the majority of the streets being impassable for carriages, the application of the processes adopted in Paris, however perfected elsewhere, would become here, an impossibility.

* The honorable M. Darcy will pardon me for publishing here his personal opinion upon a question so much agitated as to become the order of the day. But, in citing the different opinions of distinguished engineers, I could not pass in silence the remarkable report of M. Darcy, a report approved by the rest of the Council General "des Ponts et Chaussées."

On the other hand, it may be asked whether the cisterns which are under nearly all the houses in Algiers to receive the terrace rain water, and whose utility is unquestioned, would not suffer from their vicinity with the vaults.

Finally, looking upon Algiers, built like an amphitheatre, upon the borders of a sea uninfluenced by tides, we may ask if it were not rational to take advantage of its topography to carry off, at once, all the impurities of the city,

The local administration might itself appreciate the inconveniences of the sewers of Algiers, and thus, to a certain point, take account of the future situation of the enclosure sewer by comparing it with many new sewers of large section, already constructed in Consuls, Duquesne, Charte streets, &c.

It is proved that these new sewers, which date four or five years back, have undergone no repairs or cleansings since being put into service, and that they have worked perfectly. There is a total, or nearly total, absence of impurities, or of deposits, and the linings are in a good state of preservation, &c.

The impurities flow without difficulty, the sewer men and employees pass through the galleries without being incommoded by the smell. The smell is sensibly the same for all the sewers of Algiers, where ammonia slightly prevails, and not the least trace of sulphuretted hydrogen can be distinguished.

These observations were of a character to satisfy the local administration as to the future inconveniences of the sewer of the enclosure.

I would observe that these facts agree with the observations of M. Mougey, engineer, (whose loss is so much regretted by the corps,) upon the London sewers. In his Memoir upon this subject may be found the following lines:—

"Notwithstanding the irregularity of the service, and the cleaning of the London sewers, all those which, under the authority of the Westminster and Finsbury commissions, I was permitted to visit, seemed to be in very good condition; the masonry, always of brick, is remarkably well executed, the current of air is quite strong, and hardly a perceptible smell." *

The administration is well assured that, by taking certain precautions, whether for the ventilation of the galleries, or against the emanations through the water inlets, or for the cleaning, on a large scale, of the galleries by means of slushing; precautions, moreover, recommended in the report of M. Darcy, all the inconveniences signalized by the Council of "Ponts et Chaussées" have disappeared, and that there is nothing that should prevent the use of the three branches of the enclosure sewer, and the placing of water conduit pipes in them. The opinions of the Council still admitted a certain reservation.† This leaves some margin for the definite solution of an important question on which there is so great a difference of opinion.

* Annales des Ponts et Chaussées, Tome xxiii, 1838, p. 170.

† The honorable M. Darcy says, in his Report, "It is to be understood that I advance these opinions with a certain reservation: for it is always difficult to appreciate when not upon the spot, the considerations which may have guided the local authorities."

Experience has demonstrated, since the putting in service of the three branches of the sewer, that the dreaded inconveniences do not appear. Our workmen now pass through the galleries as easily as if there was only a stream of clear water. I, myself, have gone through many times without being incommoded. I only observed the prevalence of ammonia. Many interior complementary works, such as lining, pointing, cleansing, &c., have been executed since the service of sundry portions of the sewer. I affirm that the workmen labor all day without objecting or suffering the least indisposition. It is now settled that the galleries may be visited without the least danger, and that, without inconvenience, the water pipes may be laid upon the brackets, all ready to receive them.

I will, at another time, speak of the measures adopted to avoid the inconveniences of exterior emanations.

I may now be permitted to draw a parallel between the situation of the Algiers Sewer, and that of the sewers of London, Brussels, and Liege, which the honorable M. Darcy has cited in his reports as examples against the free system.

Must the inconveniences produced in these three cities, by the admission of soil matter in the public sewers, of necessity be produced in Algiers? I answer unhesitatingly, No, for their conditions are not the same.

In London, the sewers empty into the Thames, which in turn flows back on the flood tide. It often happens that in high tides the interior inundations, passing up through certain conduits, enter the cellars of the houses.

Another inconvenience of the London sewers arises from the slight inclination at several points. But the gravest of all is the deterioration of the waters of the Thames, which supplies the largest part of the water drunk in London.

This fact is proved in the Memoir of M. Mougey already quoted, and in that of M. Mille, entitled, "*Assainissement des Villes en Angleterre.*"*

None of these inconveniences can be experienced in Algiers. There are no perceptible tides, and the slopes of the sewers are much inclined, the smallest being 0·01 ft. per foot.

The report of M. Darcy tells us what occurs at Brussels. Notwithstanding the express prohibition contained in all the ancient and recent laws, of the construction of privies without inclosed cesspools; and by reason of the unaccountable toleration of this evil, there are so many houses which have put their vaults in communication with the public sewers, that they now refuse to redress the evil.

Thus, fetid and unwholesome exhalations escape from the sewers, chiefly in the low parts of the city, where the deposits accumulate.

M. Verslays, inspector of the sewers of Brussels, impressed with these inconveniences, does not hesitate to declare against the free system.

This is undoubtedly a serious matter; but it is a *forced* application

* Annales des Ponts et Chaussées, Mars et Avril, 1855.

of a system probably unsuited to the topography of Brussels, and against which no proper precautions seem to have been taken. This example proves nothing against the application of the free system under other circumstances.

The example of the city of Liege, where serious accidents have occurred in consequence of the presence of night soil in the public sewers, might prove to be a condemnation of the free system, if these accidents were not attributable to purely local causes.

A report of the medical commission of Liege asserts, that in the time of high water, the Meuse penetrates the sewers of the city, as the Thames in London; that the well water then is vitiated by the filtrations of the sewers, and that serious accidents have befallen those who used the water; all of which was attributed to the presence of sulphuretted hydrogen dissolved in the water.

These accidents the reports inform us, "*occurred chiefly in the lower "portions of the city, especially in those where the sewers are badly "constructed, or defective from decay; since, in this case, the water "from the sewers filtrates in great abundance.*"

It appears that the accidents are attributable to two local causes: the inundations of the Meuse, and the bad state of the sewers.

As to the presence of sulphuretted hydrogen dissolved in water, this would be a general cause of insalubrity, and might be a powerful argument against the free system.

We would first observe that the accidents recorded at Liege resulted from the consumption of water infected with sulphuretted hydrogen, and not from inhaling the deleterious gas.

Water can dissolve at the ordinary temperature and pressure of the atmosphere about three times its volume of this gas, and therefore in receiving night soil, the sulphuretted hydrogen can only exist in a state of solution, and never in that of gas, if the sewer only receives a certain quantity of water.

The calculation of this quantity can be approximately made for any sewer, by means of certain chemical data, in keeping an account of the population of the houses communicating with the sewers.

During the summer, the City of Algiers only receives from the aqueducts which supply it, 13·2 Imperial gallons per head, in twenty-four hours,*; and, as there is no rain there, the sewers can only receive the waste of this 13·2 gallons. This quantity of water, far inferior to that passing through the sewers of London, is still enough to dissolve all the sulphuretted hydrogen, since this gas has never caused the least accident in the sewers of Algiers, even during the hottest weather.

Blidah, another town of Algeria, enjoys the free system, to the great advantage of the population and of agriculture.

The sewers are supplied daily with an enormous quantity of water as compared with the importance of this little town (706,320 cubic feet every twenty-four hours), which is derived from the Oned-el-Kebir, and discharges from the heads of the sewer to serve in irrigating the neighboring fields.

* This quantity will reach 22 gallons on the completion of the projected works.

The sewers of Blidah having a considerable slope, there is nothing to be desired, in a sanatory point of view; while its magnificent gardens are nourished with water having in solution the principles of a valuable compost.

While in England the free system is growing more in favor, and advancing more towards perfection; and, while it is successfully applied in Algiers, there is in Belgium a strong opposition to its inconveniences.

The opinions upon this subject are still divided. In waiting for a definite solution of this question, I could not pass in silence the opinion of M. Mille, so decidedly advanced in his interesting report already quoted. He is the great partizan of the free system, and proposes its application in Paris.

It is certain that the suppression of the vaults would be an advance in a sanatory point of view; but, on the other hand, the introduction of soil into the sewers, would be attended with evils more or less serious according to the localities, and would frequently exact important works.

That a city may enjoy the free system without inconveniences, it is necessary,

1st. That it should establish sewers in all the streets.
2d. That it should have a distribution of water sufficient to dissolve all the sulphuretted hydrogen gas, and to cleanse the sewers.
3d. That it should have the means of disposing of the contents of the sewers without hazarding the public health.

It is not easy in all cases to fulfil these three conditions, and in many cities it would call for immense works.

In Paris, for example, should the first two conditions be fulfilled in part, the third would involve a large expense, whether for the construction of lateral sewers in the Seine, or for the establishment of some contrivance for the removal of organic matter, which could not be emptied into the river without endangering the public health, and which, moreover, should not be lost, being so valuable as a compost.

An idea of these works may be gathered from the vast project of John Martin, described in the article of M. Mougey upon the London Sewers, and from that of M. Forster, described in the Memoir of M. Mille. This vast project would not cost under forty million francs.

It is hard to decide upon so difficult a question. It appears to be impossible to establish general rules, and we should apply in each city processes which are found to be best adapted to its topographical situation.

Before closing, I would say a word upon the question of compost arising from the organic matter of the sewers, which appears to have been completely sacrificed at Algiers in the construction of the enclosure sewer.

No plan has as yet been proposed for gathering this fertilizing matter, which is now lost in the sea. It is not because the question has not come up before the local administration, but it did not seem well

for them to take the initiative of its application to agriculture, especially in a fertile country where manure is of less value than in France or England.

Still, if any of the industrial departments should offer to apply to agriculture the fertilizing principles contained in the sewers, it would be easy to establish at the lower ends of the three branches, wells or reservoirs, in which might be deposited organic matter, mud, &c., leaving the liquids to be decanted in the sea.

Thus far no offer of the kind has been made.

I now continue the description of the principal plans of the enclosure sewer.

The Marine Branch—The marine branch has a total length of 1033 feet, with slopes varying from ·01 ft. to ·35 ft. per foot, independently of a fall of 10·89 ft. near the lower end, and of an inclined plane with a vertical height of 6·16 ft. (Fig. 2, Pl. II.)

This fall was occasioned by the passage under an arched magazine of the military engineers. As to the inclined plane, which was not provided for in the plan, it was made to increase the depth of material under the gate of France, as well as to facilitate the construction of a tunnel, as it was not allowed to pass with an open cut.

This branch presents two principal sections, represented Pl. I., Figs. 2 and 4. Upon an intermediate length of 98 feet, the sewer has the singular form represented Pl. I, Fig. 3, an explanation of which will be given hereafter.

These sections were calculated, not so much for the draining of the 14·8 acres, as for the necessities of the interior service, visiting, cleansing, placing, and maintenance of the conduit pipes set upon the brackets.

The singular form of Fig. 3, is due to the presence of a particular portion of the sewer constructed by our service in 1846, for the provisional sewerage of the street Duquesne, with the view of ultimately becoming an integral part of the enclosure sewer. The recess seen upon the right hand side wall, was designed to support a conduit pipe. As in 1846, the definite study of the plan was not matured, an approximate level was adopted for this part, which was afterwards found to be 3·28 feet too high, on consideration of the conditions of level imposed by the branches of the sewer of the street Trois-Couleurs.

Instead of demolishing this portion of the sewer, whose masonry was excellent, it was thought best to preserve it by underpinning, and destroying only the invert, and connecting the old and new piers. This explains why the section has a height of more than 9·8 feet under the key, for a width of only 2·29 feet.

The branch of the Marine, is furnished with four man-holes, with cast iron circular ring frames and covers, for the entrance to the galleries, and nine water inlets.

The junction of all the public and private drains of this quarter, with the principal canal, is effected by a development of secondary canals attaining a length of 1158 feet, or 124 feet more than that of the principal canal.

The sewer along the left side, follows the upper side of the street of the Marine, which is constructed with arcades. The axis of the sewer is aligned 6·5 feet from the plane of the facade of the arches.

From this, branch out twenty-six private drains for the houses of the street of the Marine. The gutters, in number twenty-five, leading into the public way the terrace waters, have also been put in communication with the sewers.* This was the case also for four public urinals.

The alignement of the sewer upon the upper side of the street in preference to the centre, was adopted for two reasons: 1st. To diminish the length of the public branch sewers. 2d. To incommode as little as possible, the passing of vehicles during the execution of the work, in a street only 26·24 feet wide.

But this disposition was rather dangerous for the neighboring houses, (which are generally built on light foundations), as the level of excavation was, most generally, below that of the foundations of the pillars of the arcade. Great precautions were then needed, for taking care of the houses during the construction of the sewer. Not only were the excavations solidly shored, but a still more prudent measure was taken, that of tunneling certain portions, several feet in length. These small tunnels, which are seen in the longitudinal profile in which the sewer was constructed, served the purpose of a strong buttress for the pillars of the arcade. This method was especially adopted at the angles which were naturally the most exposed; in this way, every accident was avoided.

Another difficulty occurred at the passage of the gate-way of France, which has two openings, one for carriages, the other for foot-passengers; the alignement passed under the first. An open cut would have completely interrupted their passage, unless an enlargement was effected in the foot-way gate.

The active circulation of carriages at this point, would not admit of our stopping the only passable outlet between the city and the port. On the other hand, the military engineers were opposed to the enlargement of the little gate.

It became necessary to accomplish this passage by a tunnel, and for this reason, the above mentioned inclined plane was made, which admitted of a covering of about 7·5 feet of earth above the extrados of the arch.

This work presented some difficulties. The earth under the gate-way was made-earth. Every passing carriage occasioned a fall of pieces from the top of the tunnel, upon the heads of the workmen. Thus the work was carried on, a yard at a time, the masonry in cement keeping pace with the advance, which was maintained night and day without interruption.

Branch Bab-el-Oued.—Its whole length is 1945 feet. The slope is 0·0122 feet per foot upon the first 1476 feet. In the longitudinal profile, (Pl. II, Fig. 1), a fall of 12·1 ft. is seen, then a slope of 0·028 ft.

* From what has been said as to the existence of cisterns under nearly all the houses of Algiers, we might be surprised at the number of gutters which waste the terrace waters upon the public way, instead of storing it in the cisterns. This is due to the fact, that the houses are of French build. Every Moorish house is invariably furnished with a cistern, which, notwithstanding the obligatory decrees, is the case with but few of the French houses.

per foot to the facade of Fort Neuf upon the sea, then an inclined plane of 0·151 ft. per foot in its passage through the shore.

The fall was a necessity arising from the passage of the deep fosse along Fort Neuf.

As to the inclined plane of the shore, that was an after work. The outlet of the Branch Bab-el-Oued was, at first, established on the alignement of the enclosing wall of Fort Neuf at 13·12 feet above the level of the sea. But as, at certain periods, the impurities gathered upon the shore into an infected pool, the sewer was prolonged to avoid this inconvenience.

The new outlet was fitted into a large rock, and the impurities are delivered immediately into the sea.

The branch Bab-el-Oued presents three different sections with widths of 3·93 ft., 4·26 ft., and 4·92 ft.; and with heights under the key of 5·57 ft., and 5·74 ft. (Pl. I, Figs. 5 and 6.)

These sections are more than sufficient to deliver the product of the heaviest showers, since, according to the most liberal calculations, the water cannot rise over 1·64 ft. at the extremity of the first slope.* But, account was taken here, as in the branch of the marine, of the wants of the exterior service, and especially of the presence of two conduit pipes in the portion 4·92 ft. wide.

The branch Bab-el-Oued is provided with five man-holes and sixteen water-inlets. The secondary canals attain a development of 1220 ft. There are nineteen private drains, twenty-one gutters, and three urinals emptying in it.

The street Bab-el-Oued has arcades the same as the street of the Marine. To protect the houses, the same measures were taken as in that street. They are now more stable from the presence of the enclosure sewer at the foot of their foundations. The construction of the branch Bab-el-Oued met with some difficulties, though none very serious.

The first was in crossing Askew the street Bab-el-Oued, with depths of 23 to 26 feet. This was made by a tunnel for a length of 115 feet, and was in all respects well executed, notwithstanding the layers of made earth, and the curved alignement of the sewer. The tunnel was made in small portions at a time, taking care that the masonry should keep pace with it.

The junction of the sewer of the street of Casbah, the construction of a man-hole and two water inlets at this point, which were made in the rainy season, with a depth of 16·4 feet, in the midst of other sewers, and in made ground diluted by the filtrations of the sewers, gave us trouble of which no just idea can be formed by the mere inspection of the apparently simple sections.

The excavation was near an ill-constructed house at the corners of the streets Bab-el-Oued and of Casbah, and caused us considerable anxiety.

* The basin of the branch Bab-el-Oued has 93·9 acres. The product of a storm yielding 0·64 ft. upon the surface, would produce in the section 4·92 ft. broad, above the fall a height of about 2·9 ft. water if the section above the fall received all this product. But, it must be borne in mind that about half the basin delivers its water immediately above the fall, by the culvert which traverses the route at this point.

The street Bab-el-Oued is a new street opened in the midst of a mass of Moorish houses, which have been taken down to be replaced by French arcades. We would naturally expect to find in such a quarter, ancient excavations, such as wells, cellars, and cisterns. One of these excavations, opposite Jémima street, extends two-thirds the width of the street. The heavy carts used for transporting the blocks for the Jetties of the port, threatened to crush the arch (of Terre mise) laid bare by the excavation for the sewer. This difficulty was remedied by the speedy construction of a sustaining wall built in the night, without which the passage of the street would have been wholly intercepted.

Notwithstanding these difficulties and the delays occasioned by them, the two branches of the Bab-el-Oued and of the Marine, which were commenced at the same time, in September, 1852, were finished in 1853. Eight months sufficed, notwithstanding the winter storms, to establish under ground 2978 feet of main canals, and 2378 feet of branch canals.

A portion of the sewers which polluted the port, especially that of the two fish sewers, was diverted.

Such was the first result of this work.

(To be Continued.)

Steam Engineering in 1859.* *Application of Steam as a Motive Power.*

(Continued from page 78.)

In the preceding paper contained in the August number, the attention of the engineering reader was directed to the prevalent defects in the conveyance of steam through the pipes and cylinders; and it must be confessed that among practical men the most lamentable ignorance exists, and for the simple reason, that the evils referred to are not immediately evident. The cylinder and the steam therein make up their own accounts, and very few take the trouble to investigate the balance.

A fall of three or four inches in the vacuum is sufficient to alarm the most indifferent engineer, but a loss of 30 per cent. by condensation is not worth consideration.

Does the use of superheated steam economize the fuel? The answer to this question must be in the affirmative; facts are stubborn things, and we have just now ample proof that the economy arising from superheating steam is a fact.

Then, whence does this great economy of 20 and 30 per cent. arise? Is there some new and mysterious property given to the steam in the process of superheating? or can the improvement resulting be accounted for in an ordinary and common-sense way? We believe it can.

The results arising from the use of superheated steam reflect severely and most justly on the positive ignorance of steam engineers. How is it that there is sufficient *waste* heat from the boiler furnace in the present boilers, to supply the additional heat to the steam? We excuse

*From the Lond. Artizan, Sept., 1859.

an answer, as there are so many other considerations intermixed with the question. One thing is quite certain, that if the exact *cause* of the economy is not understood, steamship owners, at least, appreciate the *result*.

As far as can be judged from the best information and the most reliable experiments on the effect of supplying steam with heat in addition to that acquired in its generation, there is reason to believe that the practical effect of such addition, is simply to prevent the condensation in pipes and cylinders before referred to.

There are two facts connected with superheated steam that deserve especial attention.

The first is that steam, having a temperature due to its pressure, may, whilst in contact with the water, have an additional temperature of say 100° given it, so that the steam in contact with the superheated flue may be be 350°, whilst the steam and water below it are only 250°.

The second fact is that superheating steam appears to have little or no effect on its pressure; thus we have seen steam of 250° superheated to 360°, with little or no difference in the pressure—indicating that superheating isolated steam does not, *per se*, give much increased power. The question that engineers have to decide is whether the fuel is best consumed in superheating, or generating steam.

Strictly speaking, we have no right to say so much on this subject, as it is at the present time quite an exceptional one; but we hail it as an omen of better times, and a great blessing to steam engineers, tending to make them more reflective.

Steam-jackets or casings around the cylinders of steam engines are also recommended to counteract the premature condensation of the working steam. With few exceptions their adoption has given increased duty for a given consumption of fuel; and, in fact, if there is a a loss of 20 or 30 per cent. by premature condensation—a fact we believe fully proved—it is quite certain that a casing about the cylinder filled with steam of equal or higher temperature than that inside the cylinder, must of necessity prevent this loss. The question then remains as to the cost of supplying these casings; and here we undoubtedly require more definite and reliable information. Steam casings being the exception, and not the rule, experimenters have been few and far between; and unless special arrangements are made, it is difficult to estimate the relative values of the power lost by condensation in the casing, and the power gained by preventing condensation in the cylinder.

The amount of steam condensed in the casings is stated variously from 3 to 12½ per cent. of the total steam generated; in no case has it been found to exceed 12½; indeed, the average may be taken at much below that amount.

If, therefore, as has been proved beyond a doubt, the condensation in the cylinder amounts often to 30, and that in the jacket we will say to 10 per cent., the result is a saving of 20 per cent.

Again, in the cylinder the per centage of condensation increases so

rapidly with the increase of expansion, that the economy due to the increased expansion is almost neutralized; hence it is that we have never derived, and never can derive, from expansion in non-heated cylinders, the results that may be always obtained when the normal temperature of the working steam is maintained.

In steam-casings the condensation is practically uniform at all rates of expansion, and is almost uniform in point of time. Not so the working steam; it makes all the difference whether 3 lbs. or 6 lbs. weight of steam is used per stroke; in the first case (in general terms) the condensation is 30, and in the second only 15 per cent.

With those who deny that steam-casings are economical, the reason almost universally given for that denial is, that it does not matter whether the condensation takes place in the casing or in the cylinder, as the *amount* is the same in both cases. This is only a rough and ready way of burking a subject not understood.

If practice indicates opinion, steam-jackets have little to hope for from the present race of engineers. Nevertheless there are a few who at least will fairly set the question at rest by experiment before they form a decided judgment thereon.

Where money is plentiful it is freely spent, and the same may be said of fuel, with this difference—that, in the former case, a man does get something which he considers the value of his money, whilst with fuel we spend a shilling and obtain two pence as returned value.

It is quite unnecessary, even in 1859, to take any trouble to prove that 1 lb. of steam expanded in the cylinder will give out a greater power than 1 lb. not expanded; and that the power obtainable from 1 lb. of steam increases in a certain ratio with the expansion.

This remark brings us to the second point of our present subject—the *use* we make of steam in a steam engine.

It must be admitted that the expansive property of steam has been generally appreciated, and of all improvements tending to economy, has had the most supporters; and yet even this most important branch of steam engineering is neglected by the bulk of those who supply and use steam power. Is it not a fact that, on land and sea, an efficient expansion valve gear is the exception, and not the rule?

Pumping, water-works, and some other large land engines, are often fitted with arrangements for expanding to any extent; but take the thousands of small engines from 6 to 60-horse power, and, as a general rule, they have no expansion gear.

In marine engines the neglect on this point is perfectly unaccountable, and most discreditable. When an attempt is made to expand, how is it done? Why, generally, either by the link-motion, which is quite useless for large cylinders, if an expansion of four times is required; or by the cam and throttle, the latter often placed some distance from the main slide, with all the disadvantages of such an arrangement.

The introduction of the link-motion is one of the few solid improvements of the present day; for, although it can only be considered as a step in the right direction, it has been invaluable as a mechanical

arrangement, and has been *one* of, if not *the* chief cause of so much more attention to the economy of expanded steam. The marine engineer must regard the link, as a reversing gear, almost with positive affection; so handy, so certain, and, at the same time, such a fair apology, as the times go, for an expansion gear.

But the link will not enable us to expand the steam six, seven, eight, and nine times.

Before the introduction of double-ported valves in marine engines, perhaps no cut-off could be more effectual than the additional slab slide on the back of the main slide, and worked by a separate eccentric, arranged with a segment to alter the expansion at pleasure; and this plan is increasingly adopted in land engines as simple and effective. We only mention it as a plan perhaps more generally approved than any other.

With the prospect of increased pressure and increased economy, a simple and effective expansion is a great desideratum. It is quite beyond the purpose of these remarks to do more than point out the want.

The naked truth is, that the mass of steam engines are *not* fitted with expansion gear, and the owners of such are spending a shilling where six pence would more than suffice; the old story.

The link motion is better adapted for locomotives than any other description of steam engine, but yet it does not fulfil the conditions necessary for the most profitable expansion of 150 lbs. steam.

Notwithstanding the convincing arguments of those who uphold that low pressure is more economical than high pressure steam, it is to be feared the tendency of the age is to go up the pressure scale as rapidly as vessels can be invented adapted for such increased pressure; and we have a conviction not easily removed that this tendency is a progressive one. A few years ago, 10 lbs. per square inch was a high pressure for marine boilers; now 20 lbs. is the usual pressure in new contracts, whilst 25 and 30 lbs. are not uncommon; either, therefore, the low pressure advocates must be in error, perhaps through not having clearly ascertained the value of some x y in their calculations, or—sad alternative—our progress is retrogressive.

As far as our judgment and experience can be relied on, we hold the opinion that the full economy obtainable from steam as a motive power can only be realized by employing the highest pressure of steam compatible with safety; and we also believe this opinion is held so strongly by our first engineers, that it will be exemplified in their practice to such an extent as improvements in the generators will permit.

The very method of designing engines prohibits much benefit from expansion. The diameter and length of cylinder is *first* decided on, and then a boiler is designed to fill that cylinder at least half full per half stroke; and, as the boilers weaken by age, the pressure and expansion are reduced together, so that a disgraceful beginning has a miserable end.

This defect in designing is very frequent with marine engines, for, in consequence of salt incrustation, a reduction of the pressure is more certain, and occurs earlier, than in land engines.

The generator should be the starting point of design; there should be no difficulty with a thoughtful and observant engineer in ascertaining what quantity of steam can be supplied, of a given pressure, with a fixed rate of combustion, and a fixed ratio between it and the heating surface. Having fixed his rate of supply, he can, with the most undeviating certainty, decide on his revolutions, rate of expansion, capacity of cylinder, and actual power required. But no; this, the most easy, most rational process, is considered the most difficult, and your practical man tells you that to get a certain speed out of a ship, "if you have a 50-inch cylinder, you will do it." Do it? yes, as many an unfortunate ship-owner has been "done."

Before leaving this part of the subject, it may be as well to allude to the advantages alleged to be derived from the combination of a high and low pressure cylinder; and it must be admitted that such engines have been more economical than ordinary single cylinder engines. But why is this so? Is it in consequence of the two-cylinder arrangement? This has never been proved. The reason we believe to be simply this —that all double cylinders are necessarily, by their very construction, *expansion* engines; whereas the cases are rare in which the single cylinder is fitted to carry out the expansion to an equal extent. With an equal amount of expansion, the single cylinder should be the most economical; at the same time, the double cylinder arrangement, although more complicated, has the most even motion during high expansion.

We have purposely avoided any theorizing as to the realized increased duty from various rates of expansion, as such information can be obtained from many sources. By a proper use of the expansive property of steam alone, we can effect a certain saving of at least one-half of the present cost of steam power.

Our next and last subject is connected with the disposal of the steam.

In locomotives and non-condensing engines the waste occasioned by the escaping steam will be in inverse proportion to the rate of expansion, and the abstraction of heat to raise the temperature of the feed-water. With reference to the latter, a saving of from 10 to 15 per cent. may always be obtained by passing the exhaust through or over the feed-water; but even this simple arrangement is often neglected—indeed, it is so in the majority of cases.

In condensing engines it is of great importance to reduce to a minimum the units of heat passed into the condenser; and here again we recognise the importance of extreme expansion and no premature condensation. Any defect that allows 2 lbs. of steam to do only the work of 1 lb. is not only a first loss in itself, but ultimately it injures the efficiency of the condenser by admitting into it nearly the total heat contained in 2 lbs. of steam, instead of only that contained in 1 lb. Hence, it is a proved fact, that with superheated steam or steam jackets, much less water is required to condense a horse-power of steam.

In speaking of steam generation, we called attention to the apparent necessity of the loss arising from the escape of the heated gases

requisite for a draft; and now, in concluding our remarks on the disposal of the steam, we have to confess that the discharge of a large mass of heated water appears an unavoidable loss; we take only some 4 per cent. of it to feed the boiler, and the remaining 96 per cent. is wasted. The temperature of the feed-water thus supplied, averaging 100°, *may* always be raised to 200° or more, by abstracting the heat from the brine, discharge, or scum, but it *is not*.

With steam of 20 lbs., a vacuum of 10 or 12 lbs. is an important addition, but it is questionable whether the addition of 10 lbs. to a pressure of 150 will repay the cost of fitting and working the air pumps; all will depend upon the extent of expansion.

And now a word about surface condensation, and the advantages to be derived from its introduction into steamships.

It would be difficult to overrate those advantages. A saving of at least 20 per cent. of fuel—clean boilers—small air-pumps—regularity of feed—and, above all, the consequent introduction of high pressure steam.

It is matter of surprise and regret that such authorities as Mr. J. Scott Russell and Mr. Bourne should inform the young engineer that surface condensation is not sufficiently rapid. This is a bug-bear that has haunted many, and tended to repress an improvement that *will not* be repressed. It is not for us to say how or when surface condensation will be generally introduced; we can only put, on the one side, the many advantages its introduction creates, and, on the other, the trifling mechanical difficulties to be overcome, to effect its adoption. And who will question the result?

Next month we shall allude to the mechanism of the steam engine; and, in the following number, conclude the series with a *résumé* of the whole points touched upon.

(To be Continued.)

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*Boydell's Traction Engine in Manchester.**

Yesterday a trial journey from Manchester to Oldham was made with a new traction engine, which has been manufactured by Messrs. E. T. Bellhouse & Co. of Manchester, to be sent out to Rio de Janeiro, for Messrs. Carruthers, De Castro & Co. The engine, weighing about 15 tons, with a train of six wagons loaded each with 3 tons of iron, making on the whole a weight of 45 tons, was taken yesterday morning from Zara street, through the streets of the city, to Oldham road and on to Oldham. The engine performed its duty well, proceeding at the rate of two or three miles per hour, and turning sharp corners with facility and accuracy, answering to the will of the steersman with wonderful promptness.

* From the Lond. Builder, No. 880.

AMERICAN PATENTS.

List of American Patents which issued from December 6, to December 27, 1859, (inclusive,) with Exemplifications.

DECEMBER 6.

1. Hub-boring and Mortising Machines; G. M. Atherton, Friendsville, Illinois.

Claim—The arrangement of the pawls, with spring rods and arms projecting from the reciprocating gate for operating the same, in combination with lever for relieving either one or both pawls from racks, arranged for the purpose of moving the carriage with the hub up to the mortising tool.

2. Machines for Clearing Rice; Wilson Ager, Rohrsburg, Assignor to T. J. Wolf and P. J. Jordan, Philadelphia, Pennsylvania.

Claim—1st, Giving the grain a positive outward motion from under the pressing wings by the clearer. 2d, The adjustable leaves upon the wings, for aiding the upward movement of the grain.

3. Grinding Mills; C. P. Buckingham, Mount Vernon, Ohio.

Claim—1st, The method of securing the spindle to the runner stone of a grinding mill, by combining the flanch at the end of the spindle and the ring attached to the metal cap of the runner, said ring being provided with projections which shall permit a rocking motion of the stone upon the spindle, and a key. 2d, The use, in connexion with the bed-stone of the elastic bars, for the purpose specified.

4. Steam Boilers; B. N. Burke, Buffalo, New York.

Claim—The employment, in combination with the flues, arranged as described, of draft distributors, applied and furnished with apertures of varying size.

5. Steam Boilers; B. F. Campbell, Roxbury, Massachusetts.

Claim—The combination of the exterior water chamber and interior water chamber, the interposed smoke flue and the basin, arranged to operate as set forth.

6. Washing Machine; C. Carter, Franklin, Iowa.

Claim—The inclined wash-board, fitted between ways or guides, which have a sliding or reciprocating rubber frame fitted on them by being hinged to slides, fitted within a suitable box or suds' receptacle, and arranged as set forth. Further, the arrangement of the rubbers filled within the hinged reciprocating frame, and used in connexion with the inclined wash-board.

7. Sewing Machines; Edwin Clark, Windsor, Vermont.

Claim—The combination of the bar, which has its front end or needle controlled by a double fulcrum guide, so as to describe an ellipse, and its rear end attached to a rotating disc or crank pin, with a perforating needle.

8. Projectiles for Rifled Ordnance; J. W. Cochran, City of New York.

Claim—Fitting a projectile with a hollow case, jacket, or band, containing gunpowder or other explosive material, which, when ignited by the firing of the charge of the gun will, by its explosion, cause the said case, jacket, or band to be expanded toward the bore of the gun, and to be compressed around the projectile. Also, in combination with an expanding case, jacket, or band applied to a projectile, the use of an outer covering of wire cloth to constitute a packing.

9. Harvesters; William Cogswell and Ira Cogswell, Jr., Ottawa, Illinois.

Claim—The combination of the shifting pinion with the eccentric axle and adjusting frame, so that by turning the said axle, the pinion will be thrown into gear with either of the concentric wheels, or out of gear with both, and so that the height of the main frame may be readily adjusted to correspond with the adjustment given the axle and the pinion.

10. Water-wheel; J. P. Collins, Troy, New York.

Claim—1st, The arrangement of the lighter plate, in the particular manner specified. 2d, The arrangement, in the particular manner specified, of the packing ring. 3d, The arrangement, in the particular manner specified, of the lip or projecting piece of the buckets. 4th, The arrangement, in the particular manner specified, of the regulating plate, in combination with the peculiar specified device for operating it. 5th, The employment or use of the dividing strip or annular ring inserted in the buckets, as set forth. 6th, The employment for united use, in one wheel, of the lighter plate, packing ring, projecting lips, or flanches, gauge or regulating plate, and annular dividing plate, arranged in the manner set forth.

11. Boxes of Vertical Sugar Mills; John Cooper, Mount Vernon, Ohio.

Claim—The concentric cups upon the upper sides of the heads, the same being furnished with the openings for the conveyance of the oil from the upper box to the stationary cup which surrounds the shaft upon the lower bed plate, in combination with the cups, as described.

12. Skate Fastenings; T. P. Costello, Buffalo, New York.

Claim—A boot, with sockets therein, as described, and upright bolts welded to a steel blade or skate runner, both being made and arranged as described, and attached to each other.

13. Horizontal Water-wheels; E. G. Cushing, Dryden, New York.

Claim—The combination of the tubes with the bolts and buckets, arranged as described.

14. Hook-headed Spikes; G. W. R. Bayley, Brashear, Louisiana.

Claim—The improved railroad spike, having the sides and front of its head beveled downwards and inwards, but convex, and having the peculiar projecting lip or hook behind, for facilitating its easy withdrawal.

15. Melodeons; C. G. Burke, Utica, New York.

Claim—Fitting a melodeon, or other reed instrument of the same class, with a series of swell valves, so applied as to be capable of being operated by the keys in playing, for the purpose of giving expression to any note, independently of the preceding or succeeding ones or of the other notes of a chord. Also, the employment of a stop, applied and operating in combination with the keys and swell valves.

16. WIND-MILLS; Jacob Dickerson, Sacramento, California.

Claim—The arrangement of the curved iron sections, sails, arms, slides, hollow drum, scroll spring, flexible connecting rods, and links, in the manner described.

17. SEWING MACHINES; C. W. Dickinson, Newark, New Jersey.

Claim—The construction of a pendently swinging, gravitating, self-adjusting pressure pad or stripper formed with an adjustable slotted end suspended on an adjusting pin or stud, the said pad having no feed pressure spring.

18. CARDING ENGINES; Jephtha Dyson, Fulton, South Carolina.

Claim—1st, The combination and arrangement of the feed regulating and working cylinder, feeder, worker, c, and clearer, in the manner described. 2d, The combination and arrangement of the feeder, worker, B, cleaning and delivering cylinder, and main cylinder, as described. 3d, The combination and arrangement of the feed regulating and working cylinder, feeder, worker, c, clearer, worker, B, clearing and delivering cylinder, and main cylinder, in the manner set forth. 4th, The combination, with the features included in the third claim of the stripper, in the manner set forth.

19. CORN CRIBS; A. B. Furbee, Dresden, Ohio.

Claim—The arrangement of the inclined flooring with the trunks or boxes, as set forth. Also, covering the posts of the crib with sheet metal, when said posts are used in connexion with a crib provided with an inclined flooring and trunks or boxes.

20. PLOUGHS; Jackson Gorham, Bairdstown, Georgia.

Claim—The arrangement of the vertical curved standard, shovel, curved handle straps, hooked inclined brace, adjustable brace, and adjustable beam, as described.

21. MACHINERY FOR CUTTING LEATHER INTO SOLES FOR BOOTS AND SHOES; Caleb H. Griffin, Assignor (through mediate assignment,) to Walter D. Richards, Lynn, Massachusetts; ante-dated June 6, 1859.

Claim—1st, Vibrating the knife or knives in the arc of a circle or a curve approximating thereto, in the manner set forth. 2d, The arm, stud, and slot, or their equivalents, as combined with the knife or knives.

22. RAILROAD CAR BLINDS; Daniel M. Hall, Bridgeport, Connecticut.

Claim—The use of the flexible blind, arranged with the rollers fitted within the curved grooves, and applied to the window of a car, or other wheel vehicle, so that it may be raised above the sash, and drawn within the roof of the vehicle.

23. BEARINGS OF RAILROAD AND OTHER MACHINERY; Alexander Hay, Philadelphia, Pennsylvania.

Claim—Imbedding the bearings of journals or surrounding the same with india rubber, or other suitable elastic material, so as to cause them to yield in every direction when subjected to strains and thrusts, and re-adjust themselves upon the pressure being removed.

24. DRYING WET SEED-COTTON; George G. Henry, Mobile, Alabama.

Claim—The application of artificial heat for the purpose of drying wet seed-cotton, by means of mechanism.

25. PITCH-FORKS; John Herald and C. B. Tompkins, Trumansburg, New York.

Claim—The arrangement of the hollow head and tines, passing through the head socket, handle, screw plugs, and screw tangs.

[This invention consists in constructing the head in T-form, of cast metal, hollow; the teeth being secured in the head, and the head secured to the handle.]

26. MOLE PLOUGHS; F. E. Hinckley, Galesburgh, Illinois.

Claim—1st, The combination of the clearer or hanging coulter and the rotating coulter, arranged as described. 2d, Constructing the sword of a mole plough with a hole or bore through it, of sufficient size and suitable shape to admit at the same time a rod of metal large enough to raise and lower the point of the mole, and also to admit the air to pass free into the drain through the sword and mole. 3d, Expanding and contracting the mole of a mole plough described, or by any other mechanical means. 4th, Constructing the mole of a mole plough in sections consisting of two sides and a top, hinged to a head block and operated by a wedge. 5th, Two revolving cutters, with plain outsides and conoidal insides, which may be placed upon a common axle and adjusted to the beam in such a manner as to be forced to cut into the ground, and press the earth laterally into the sword, cut and firmly close it up.

27. PORTABLE COLLECTION BOX; Truman J. Homer, St. Louis, Missouri.

Claim—The whole box as a portable collection box, in the peculiar arrangement of its component parts of glass, wood, and metal. I particularly claim the money inlet, it being in the shape of a box without a bottom, through the top of which is inserted a narrow flat tube, and between it and the sides of the box are two ranges of discs, which discs close the aperture of the tube when the box is inverted.

28. MACHINES FOR RAISING WEIGHTS; Sheldon A. Hotchkiss, New Haven, Connecticut.

Claim—The zone and the screw drum, pawl hook, knee, and sheeve, in combination, as set forth.

29. INDIA RUBBER FABRICS; E. E. Marcy, City of New York.

Claim—The improved india rubber fabric made by the combination of india rubber with hypo-sulphite of zinc, and by the exposure of said compound to steam or water at the temperature stated, without any admixture of free sulphur.

30. INDIA RUBBER FABRICS; E. E. Marcy, City of New York.

Claim—The improved india rubber fabric made by the combination of india rubber with sulphuret of lead and carbonate of lead, or the protoxyde of lead, and by the exposure of said compound to steam or water at the temperature stated, without any admixture of free sulphur.

31. INDIA RUBBER FABRICS; E. E. Marcy, City of New York.

Claim—The improved india rubber fabric made by the combination of india rubber with the sulphuret of zinc and hypo-sulphite of zinc, and by the exposure of said compound to steam or water at the temperature stated, without any admixture of free sulphur.

32. APPARATUS FOR SETTING AND COPYING MUSIC FOR THE BLIND; Emanuel Marquis, Bloomington, Indiana.

Claim—The tablet, or its equivalent, with raised staves and sockets, in combination with detached solid notes, and other signs of musical notation, or their equivalents, capable of being transposed on and fixed in the table.

33. Breech-loading Fire Arms; Samuel W. Marsh, Washington City, D. C.

Claim—The construction and application of a detachable-headed breech pin, with a split female expanding ring or collar, and a non-expanding male collar or ring, and a detachable adjusting screw head, forming a compound, expanding, detachable-headed breech pin, as shown.

34. Apparatus for Sanding Painted Surfaces; Edwin May, Indianapolis, Indiana.

Claim—The combination and arrangement of the blast fan in cylinder, A, conductor, adjustable mouthpiece, with the elastic tube, or its equivalent, arranged as set forth.

35. Breech-loading Fire Arms; Edward Maynard, Washington City, D. C.

Claim—1st, The peculiar manner of connecting the barrel to the breech-piece, viz: the hook on the underside of the barrel, taking hold of the pin, or the equivalent thereof, at the front end of the breech-piece, while the link, the lever, and the joint pins of said link and lever are arranged in such a manner, with relation to the slot in the breech-piece, and the ears on the underside of the butt of the barrel, as to form a treble-jointed and compound leverage connexion between the breech-piece and the butt of the barrel, of such a character that the barrel can be instantly thrown from a firing position to a loading position, and vice-versa; and also of such character that the barrel can be easily and quickly detached from the breech-piece or be securely united thereto, in the manner set forth. 2d, The combination of the metallic block, the screw, c, and the screw, a, with each other and with the front portion of the breech-piece, and in such a manner, with relation to the shoulder on the underside of the barrel, that the joint between the butt of the barrel and the abutment of the breech-piece can be tightened or loosened. 3d, Retaining the pivot pin in its position within the breech-piece, by means of the overlapping head of the screw—but this I only claim when the longitudinal groove in one side of a portion of the length of said pivot pin, is so located that when the pin is turned to the position shown, or any other previously-determined position, it may be drawn out far enough (and only far enough,) to detach the said pin from its hold upon the lever, and thereby allow the barrel to be separated from the breech-piece. 4th, When the pivot pin is retained in its position within the breech-piece by the overlapping head of the screw, in such a manner that it can be loosened by partially turning the same upon its axis—I also claim the arm upon the outer end of said pin, which enables it to be readily turned upon its axis, and partially withdrawn from its place without any mechanical assistance. 5th, When the barrel is connected to the breech-piece in the within described manner, I also claim the producing of a tight joint between the butt of the barrel and the abutment of the breech-piece, by combining therewith a flanch-bottomed metallic cup. 6th, Giving the opposite faces of the butt of the barrel such a shape, that the flanch-bottomed metallic cup can be easily taken hold of by the thumb and finger of the free hand of the user, when the barrel is thrown into the loading position.

36. Mode of Operating Car Brakes; G. W. Mitchell, Jackson, Tennessee.

Claim—The flanched or ratchet wheel and its hooked pawl, as described. Also, the spring platform and the pin attached, and stop-pin, as described.

37. Sewing Machines; G. W. Mitchell, Jackson, Tennessee.

Claim—1st, The combination of the crank on the driving shaft, the slotted arm forming a portion of the same lever with the needle arm, and so extended as to operate the lever, F′, and the lever, E′, carrying the shuttle or looper, arranged as described, to drive the needle and shuttle. 2d, The vertically and horizontally elastic arm, having the presser attached, and constructed so as to be operated upon by an appendage of the needle to feed the material. 3d, The polygonal collar fitted to turn upon the needle arm, so that any one of its sides may be presented to act upon the presser arm for the purpose of feeding the cloth more or less, according to the wish of the operator.

38. Iron Ships; Richard Montgomery, City of New York.

Claim—1st, Forming the supports or frame to which the side covering is attached, of iron or other metal corrugated, in the form and for the purposes as described. 2d, The combination and arrangement of the corrugated cross-beams and corrugated bottom supports with the iron divisions, as set forth.

39. Broiling Apparatus; Oscar F. Morrill, Boston, Massachusetts.

Claim—The improved steak broiler, as made with the deflector in its grid or grating, a flame and heat passage under the deflector, and, with the gravy trough, to surround or encompass the heat passage.

40. Clutch for Pulley Coupling; John Knickerbocker, Stockport, New York.

Claim—Suspending the clutches or impellers in radial slots in the disc of the movable pulley, so as to allow them to vibrate in the manner set forth.

41. Mode of Securing Photographs, &c., to Tombstones; N. W. Langley, East Cambridge, and Henry Jones and A. S. Drake, Stoughton, Massachusetts.

Claim—Securing daguerreotypes, photographs, &c., upon tombstones, by inclosing them in a glass case, the opening to which is closed by a glass stopper, and affixing the same to the stone.

42. Mounting Precious Stones, &c.; Thomas J. Linton, Providence, Rhode Island.

Claim—The improvement in making mountings for precious stones, and other articles of jewelry, which are to be mounted by forming the border setting and beveled edge from a single sheet of metal, at one operation, by the use of a die, in the manner described, the mountings being in an oval, round, square, or other form, as the article to be mounted may require.

43. Cotton Seed-hullers; Charles A. Lowber, Medina, New York.

Claim—Making the runner with the surface next to the shaft smooth, to receive the cotton seed from a suitable hopper and cause them to be properly distributed thereon, and to be carried towards the periphery, and with that part or the surface within the periphery, and outside of the smooth part armed with teeth in the form of long cutting edges, having continuous channels or furrows between them of sufficient size to receive a cotton seed and permit it to pass and roll therein, in combination with an upper plate surrounding the eye or aperture for the passage of the cotton seed to the smooth part of the surface of the runner, the under surface of the said plate being parallel with the surface of the said runner, and armed with a ring of teeth in the form of long cutting edges, and formed with interposed channels or furrows similar to those of the runner, but of reversed inclination, as specified. Also, making the said teeth of long cutting edges, and surrounding the smooth surface of the runner of varying lengths, as described, that is, having some of them approaching the shaft nearer than others, that the seeds, while traveling outward on the smooth surface of the runner, may arrange themselves and properly enter the furrows or channels one by one. Also, surrounding the periphery of the runner and upper plate with a trough which extends within the periphery of the runner, leaving an open space or air passage between, in combination with the vanes, or equivalent means, for blowing in a current of air, as specified.

44. SPARK-ARRESTERS AND CHIMNEYS FOR LOCOMOTIVE ENGINES; Washington A. Peaslee and John O. D. Lilly, Indianapolis, Indiana.

Claim—The construction of a chimney or spark-arrester, by the combination and arrangement of the various parts, as described.

45. BOILER-FEEDING APPARATUS; Nathan Pucket, Deming, Indiana.

Claim—The arrangement of the chamber, valve, chest, and openings, as described.

[This invention consists in attaching a rectangular valve chest or chamber to the boiler, which communicates with the same through an aperture above the low water line, and with a feed-pipe extending to a heater in which the water is heated to a boiling point, through an aperture above the high water line, and providing said valve chest or chamber with a reciprocating valve, containing a chamber which shall alternately communicate with the openings leading to the feed-pipe and boiler, and receive from the former a full supply of water heated to a boiling point, which, when conveyed below and made to communicate with the water in the boiler, will evolve steam and discharge itself into the boiler until an equilibrium is established with the water in the same, thus producing a self-regulating feeder.]

46. HINGES; Samuel M. Richardson, City of New York.

Claim—Constructing hinges for blinds, by the bent straps passing around the outer edges of the blind, and enclosing the angle thereof, combined with the eye connected to said bent strap, by the part, e.

47. HARVESTERS; D. Sanford, Taylor, Illinois.

Claim—1st, The sliding rake bar fitted within the bent arm, and provided with a jointed rake head, in connexion with the guide strip and a gavel passage on the platform. 2d, The combination of the tilting gavel receiver with the tilting box, arranged to operate automatically.

48. CHURN; Henry Bohrer, Strasburg Township, Lancaster Co., Pennsylvania.

Claim—The application of the tube, I K, to enter the rear head of the churn, the connecting pipes, C and H, and its wide mouth, partition, and connecting tubes, L M, with the dashers elevated on an open step, combined in the manner specified.

49. ARTIFICIAL HANDS; Wm. Selpho and James Walber, City of New York.

Claim—1st, The arrangement of the cords or catguts and the pulley, as set forth, for applying a double purchase in opening the hand. 2d, The arrangement of the wrist-joint and hand spring, whereby the said spring can be adjusted by the rod that passes through the pipe. 3d, The cord, or its equivalent, passing from the elbow-pad, and giving motion at the wrist, as specified.

50. SHEET METAL COFFINS; Isaac C. Shuler, Amsterdam, New York.

Claim—1st, The arrangement of stiffening the base of a sheet metal coffin by locking together the surplus edges of the walls and bottom, forming a rim surrounding the base, also the frame. 2d, The inside tray, whose bottom is in permanent contact with the exterior bottom, and whose sides may be soldered directly to the walls or set away, leaving a chamber to be filled with molten metal. 3d, The arrangement of scrolling or double-locking the walls at the corners, in order, by making a voluminous joint, to stiffen and brace the general structure, whether the body of the joint be formed on the inner or outside of the coffin. 4th, The slotted or double rim, through which the walls protrude, for the purpose of stiffening the upper edges of the walls and sustaining the lid or cover; also, the arrangement of folding the surplus edges of the walls over the frame. 5th, Stiffening the cover with the frame near its outer edge on the upper side, enclosing the surplus sheet metal over the same. 6th, For the purposes of stiffening the respective portions of the coffin, the frames of cast or wrought metal, for the blind, for the cover, for the walls in the vicinity of the handles, for the upper edge of the tray, for the exterior bottom. 7th, I disclaim hinging the sections of the concave sides of the cover to the body of the same, but—I claim hinging them to the body of the coffin.

51. HAY-MAKING MACHINES; J. C. Stoddard, Worcester, Massachusetts.

Claim—1st, The rake head shaft, furnished with friction wheels or rollers, which are arranged on pivoted lever bearings, in combination with driving wheels which are furnished with a plain flanch for the friction rollers to act against, so that the necessary friction may be produced either by means of the specified lever arrangement, or by the same in combination with the gravity of the rake head, as set forth. 2d, The adjustable spurred ring, set-screws, with the wheels on the ends of the rake bars, arranged as set forth.

52. SAW-MILLS; Samuel Tasver, White County, Arkansas.

Claim—1st, The arrangement of the parts—I say arrangement, because I cannot claim the invention of pulleys, saws, rollers, shafts, &c., these being in use everywhere, but simply claim the peculiar manner in which they are arranged. 2d, The construction of the saw carriage, as described.

53. MACHINE FOR MAKING CIGARS; Thomas Thorpe, City of New York.

Claim—1st, The arrangement of the drums or pulleys, in connexion with the rollers, M, and belt, with or without the rollers, N, as set forth. 2d, In connexion with the above, the ranged wheel, or its equivalent, arranged in the manner set forth. 3d, The means described, of regulating the pressure on the cigar. 4th, The arrangement of a machine, as set forth. 5th, The peculiar steady curves or bends given to the belt, for the purposes mentioned.

54. ROTARY CUTTER-HEAD; J. P. Tice, Baltimore, Maryland.

Claim—The employment or use of a cylinder, or any segment or section thereof, applied to rotary cutters, to operate as set forth.

55. WASHING MACHINE; George W. Tolhurst, Liverpool, Ohio.

Claim—Constructing the round follower of washing machines of two sets of rings or hoops, and furnishing each set of rings with a handle, so that the surface that comes in contact with the clothes can move in opposite directions at one time; and this I claim when the same is arranged for operation, in the manner described.

56. MACHINE FOR GIRDLING AND FELLING TREES; A. P. Torrence, Oxford, Georgia.

Claim—The employment or use of the handle, provided with a cutter, and connected to a draft lever by the bars, or any equivalent means, so as to operate substantially as set forth.

57. CLAPBOARD GAUGE; Hiram Van Dusen, Phelps, Assignor to self and H. Rockfellow, Clifton Springs, New York.

Claim—A gauge for fitting clapboards for railing, composed of the bar, the arm, the slide, with the cam and lever by which it is actuated, the stop, and the straight edge, or their equivalents, arranged as set forth

58. ROLLERS FOR PRINTING PAPER HANGINGS; Theodore Van Deventer, New Brunswick, New Jersey.

Claim—The combination of the conically bored and grooved bushes, the concentric feathered collars, the feathered and screwed shaft, and the nuts, applied as described.

59. DENTAL APPARATUS FOR RELIEF OF PAIN WHILE OPERATING; Nahum Washburn, Bridgewater, Mass.

Claim—The combination of dental forceps, or instrument for operating upon teeth, with electro-magnetic mechanism, or its equivalent, so that the electrical current or currents may be made to flow through the nerve or nerves of the tooth, or the jaw or flesh immediately contiguous thereto, in order to benumb the same and render such more or less insensible to pain during the performance of the dental operation. Also, particularly the application of the electrical apparatus to the dental instrument, so that the latter may be in, or form part of, the circuit, as specified.

60. THRESHING MACHINES; D. A. Willbanks, Harmony Grove, Georgia.

Claim—The peculiar construction of the wrought iron ribs, in combination with the peculiar construction and arrangement of the cylinder heads, to wit: the ribs with angular hooks, and the cylinder heads with key seats, and with the slotted projections and radial slots, as set forth.

61. PLOUGHS; William F. Yeager, Starkville, Mississippi.

Claim—The arrangement of the land-side, the shank, slot, brace, T, lug, beam, brace, X, handles, share, cutter, and mould-board, constructed as described.

62. REGISTERING MACHINES; George W. Atkins, Milton, Delaware, and William B. Aitkins, Philadelphia, Pa., Assignors to G. W. Atkins and J. B. Henry, Delaware City, Delaware.

Claim—1st, Making the ratchet wheels in pairs secured together, with their notches inclined in opposite directions, in combination with both an actuating and a checking pawl, operating together simultaneously, arranged in the manner described. 2d, The employment of a self-righting cover, operating in combination with the platform, or its equivalent, in the manner described—and this we claim whether the said cover be applied either to a fixed platform or floor, or to the moving platform of a weighing scale, connected with a registering machine. 3d, The bell-striker, when the same is constructed with arms, and operated by the notches of the ratchet wheel, as described.

63. TOOL FOR FINISHING FELLOES; Charles H. Dennison, Guilford, Assignor to A. Miller, Brattleboro', Vt.

Claim—1st, The described washer and the iron gauge for trimming and shaping the internal surface of felloes, &c. 2d, The described collar gauges for squaring the external and internal curved surfaces of the felloe.

64. LADLE AND FORK; William B. Dunbar, Waterbury, Assignor to self and George H. Seymour, Plymouth, Connecticut.

Claim—The combined ladle and fork, constructed in the manner described.

65. CASTING BOXES FOR WHEEL HUBS; Thomas Ellis, Assignor to self, W. A. Ellis, and A. D. Ellis, Philadelphia, Pennsylvania.

Claim—Supporting the sand core between two sand heads, when the above parts are employed in connexion with a sand mould, in the manner represented.

66. MACHINES FOR FORMING HAT BODIES; Richard Fitzgerald, Assignor to James Booth, Newark, New Jersey.

Claim—1st, Distributing the fur on the former by discharging the same through an annular opening, over and co-centric with the former. 2d, The employment or use of the stationary shell provided with the recess, cards, or pickers, q r, and having within it the co-centric rotary wheels, one or more, also provided with cards or pickers, v u, and with or without fan blades, arranged relatively with the former. 3d, The employment or use of the slide with the sliding tube or pipe fitted therein, containing the former shaft, the box, and elastic belt, or its equivalent, arranged relatively with the suction fan, and the shell, and wheels, as specified.

67. HORSE HAY RAKES; George N. Hall, Assignor to self, S. Arthur, and J. Pierce, Mamakating, New York, and D. S. Arthur, City of New York.

Claim—The arrangement of the main lever, intermediate link, auxiliary lever, connecting rod, cam, arm rake head, slotted brace bar, and driver's seat, as set forth.

68. STEAM PLOUGHS; James W. McLean, Assignor to self and Edwin May, Indianapolis, Indiana.

Claim—The arrangement of the ploughs, gearing, cutters, lever, and connecting rod, in combination with the universal jointed shaft, when operated in connexion with the steam engine, as set forth.

69. PEG TUBES AND DRIVERS; John P. Kemp, Charlestown, Massachusetts, Assignor to N. F. Stevens, Moultonboro', New Hampshire.

Claim—Constructing the interior peg-guiding portion of the tube of a form made up of angles or corners and surfaces, as described, and so that, while the cross section or area thereof is materially greater than that of the peg, to admit of a driver of increased strength and materially greater cross section or area than that of the peg working therein, said tube in its peg-guiding portion serves, by its corners or angles and surfaces, to restrain the peg from lateral shake or play.

70. CATTLE PUMPS; Warren Nichols, Lima, Assignor to self and Thomas Ghormley, Stokes, Ohio.

Claim—1st, The combination with the covers of the stops which will open the trough, when its corresponding platform rises to its highest position, and close it when the platform descends to its lowest position, as described. 2d, The arrangement described of the spout, in combination with the arm or with some other part operated by the descent of one of the platforms, by which the direction of the water is changed near the close of the descent of the platform.

71. CUT-OFF VALVES OF STEAM ENGINES; George H. Reynolds, Assignor to Caleb Barstow and D. D. Badger, City of New York.

Claim—The arrangement within each steam chest of a rotary engine of the starting and reversing valve having the cut-off valve, in combination therewith, the two being so coupled and operating that the starting or reversing may be effected without coupling or uncoupling any of the connecting parts, in the manner set forth.

72. MODE OF APPLYING SULPHUROUS ACID GAS IN THE DEFECATION OF CANE JUICE; Nancy P. Brashear, of the Parish of St. Mary, Executrix of Robert B. Brashear, deceased, late of Pattersonville, Louisiana.

Claim—Subjecting sugar cane juice, or other saccharine liquid, to the direct action of the fumes of burning sulphur, such liquid being employed in a diffused state, so that every or nearly every portion of the whole body of liquid is brought in contact with the same almost simultaneously, as set forth.

73. Fastening for Cartridge Boxes; Rebecca H. Willson, Administratrix of the estate of John M. Willson, deceased, Washington City, D. C.

Claim—A cartridge box fastening, composed of hinged lever and spring, said spring serving to hold the lever open or closed, and said lever, by the aid of said spring, clamping the flap of the cartridge box between itself and the side of said box, as represented.

DECEMBER 13.

74. Car Couplings; Luther Adams, Blanchester, Ohio.

Claim—The combination and arrangement of the latch, spring, and plates, constructed as described.

75. Cotton Seed Planters; Peter B. Baker, Wall Hill, Mississippi.

Claim—The arrangement of the teeth in front of the drill-opener, and the scraper secured upon the spring runners or shoes, in combination with the seed drum, in the manner specified.

76. Sash-fastener; Nelson Barnum, St. Louis, Missouri.

Claim—The lever, the adjustable connexion, and the springs, and bolt, in combination with the yielding strip, as specified.

77. Running Gear of Vehicles; A. R. Bartram, Redding, Connecticut.

Claim—Attaching the front axle to the bolster, by means of the sleeves fitted loosely on the bolster and connected with the bar, which is attached to a circle plate or any suitable swivel connexion, between the said bar and axle, when said parts are used in connexion with thills, or a draft pole attached rigidly to the axle.

78. Double Eye-piece for Optical Instruments; Alexander Beckers, City of New York.

Claim—Connecting a stereoscope or other optical instrument, with double eye tubes, sight tubes, or eye-pieces, each of which being shaped or turned of one piece in the form of an obliquely intersected and moulded hollow cylinder, in the manner described.

79. Composition for Kindling Fire; Elizabeth Bellinger, Mohawk, New York.

Claim—The inflammable gum paste composed of Kaurie gum, camphor, and wax, in about the proportions stated, when combined with friction-match paste, placed on kindlers for fires, in the manner set forth.

80. Bolting and Cleaning Clover Seed; John H. Birdsell, West Henrietta, New York.

Claim—1st, Operating the bolts so as to impart to them an oblique alternately rising and falling motion, by means of the double crank, guide rods, arms, and connecting rods, or their equivalents, in the manner set forth. 2d, Arranging the trough provided with endless conveyors, for the purpose of returning the unhulled seed or tailings to be again submitted to the operation of hulling.

81. Seed Planters; William Blessing, Jeffersonville, Ohio.

Claim—The arrangement of the top portion of the distributor made with a semi-lunar opening, and the recess under the covered portion of the said top, when the periphery of the top is made with the chaff openings on either side of the reciprocating seed bar, so that said bar, by its reciprocating action, shall work out the chaff through the passages on either side of the seed bar, and thus prevent choking the distributor.

82. Striking Apparatus for Gongs; Jeremy W. Bliss, Hartford, Connecticut.

Claim—1st, Arranging the striking mechanism of a bell within the hollow bell, when the wire which actuates the mechanism moves in lines parallel to the axis of the bell, or nearly so. 2d, A rock shaft arm, arranged with reference to the bell, in combination with a slide, a swing-catch, and a hammer, and hammer wire, and proper springs, as set forth.

83. Grinding Mills; John Broughton, City of New York.

Claim—1st, The double and reverse-acting conical grinding surfaces, constructed as set forth. 2d, In combination with a revolving grinder and hollow case or drum, I claim the wings or fan blades, operating as set forth.

84. Portable Fences; Peter M. Brown, Carrollton, Illinois.

Claim—Giving such a shape to the slots at each end of the sections, that the said sections can be securely interlocked with each other by means of supporting posts of the within described shape, in such a manner that the said sections can be either lengthened or shortened when they are put up for use.

85. Fan-governors for Steam Engines; Isaac Y. Chubbuck, Roxbury, Massachusetts.

Claim—Combining the main spindle of the fan-governor with the stem or spindle of the valve, by means of a toothed arc formed upon, or attached to, the extremity of the crank arm which carries the fan, and a toothed sector upon the valve stem, the said crank arm being attached to a sleeve fitted to the spindle.

86. Machines for Winding Thread on Spools; Hezekiah Conant, Willimantic, Connecticut; patented in England, June 22, 1859.

Claim—1st, The combination of a traverse changer with right and left-hand screws, and with nuts which are alternately in gear with such screws, the combination operating as a whole. 2d, A traverse changer provided with successive steps or teeth, substantially such as is before described, and acting upon lips, as set forth. 3d, A stop motion, for causing the machine to come to rest when a spool is filled, in combination with automatic apparatus, for regulating the length of motion and change of direction of motion of a guide, through which the thread is delivered on to a bobbin or spool. 4th, Adjustable lips, in combination with a traverse changer, whereby spools of different lengths may be wound by the use of the same traverse changer. 5th, Mounting the presser and thread guide directly upon or attaching it firmly to the traverse rod, as before described, whereby the machine is cheapened and performs its work more accurately. And lastly, in combination with apparatus such as described, for governing automatically the motions of a thread guide, I claim a tension apparatus and stop motion which arrests the motion of a machine when a thread breaks, by the mode of operation set forth.

87. Sash Weights; John B. Cornell, City of New York.

Claim—My improved metallic sash weight, the peculiarity of which consists in its having a series of annular grooves formed at suitable distances from each other, in the lower portion of said sash weight.

88. Machine for Wiring Blind Rods; Thomas R. Crosby, Newark, New Jersey.

Claim—1st, The use, in wiring machines, of the yielding mouth to hold the wire when being driven and formed. 2d, The use of the adjustable slide, in the manner described. 3d, In said machines the use of the

dog in the end of the arm, in the manner described. 4th, The combination together of the driver and the yielding mouth formed by the rack and plate.

89. NEEDLE WRAPPERS; R. Crowley, City of New York.

Claim—The incision of the wrapper, so as to expose the heads of the needles and produce a covering or flap of the form shown, or equivalent form.

90. MACHINE FOR MAKING CLASPS; Jonathan Cutler, Chicopee, Massachusetts.

Claim—1st, The sliding former and the vibrating lever, in combination with the die and punches. 2d, The reciprocating ring to actuate the slide former, in combination with the revolving cam, lever arm, and pin, M. 3d, The centre spring pin, W, to press the blank down through the die plate on the forming bed, in the manner described. 4th, The whole arrangement in combination, as an organized automatic machine, in the manner set forth.

91. SEEDING MACHINES; O. H. Dennis, Altona, Illinois.

Claim—The combination and arrangement of the cylinder, G, of circular cutters, with the cultivating and opening teeth, and with the sowing cylinder, H, in the manner set forth. Also, in combination with the above, the arrangement of the loosely hinged harrows, in relation to each other and to the frame of the machine, and in combination with the arms, rock shaft, lever, and catch.

92. STONE-LOADING WAGONS; D. S. Fancher, Logansport, Indiana.

Claim—1st, The inclined frame or bed and the hinged drop, in combination with the friction rollers and the windlass. 2d, The receiving table, in combination with the clamps, as described.

93. STEAM PLOUGHS; J. W. Fawkes, Christiana, Pennsylvania.

Claim—1st, The arrangement of the clutch, levers, M N, rod, lever, b', and button or projection, on the chain, F, whereby the chains, F F, are wound on the pulleys of the shaft, and stopped automatically at the proper time. 2d, In combination with the above, the brake and pawl, when applied to the machine to operate simultaneously, as described.

94. GAS METRES; Thomas B. Fogarty, Charleston, South Carolina.

Claim—1st, The combination with the water reservoir and the revolving measuring drum, of an inclined feed wheel, as set forth. 2d, The arrangement of the overflow pipe, in combination with the water reservoir, metre chamber, dry well, and pipe, in the manner set forth. 3d, The arrangement of the water inlet, in the manner set forth.

[This invention consists, first, in the arrangement of an inclined wheel within a separate reservoir made by elongating the case of the metre, and in fixing upon the periphery of this wheel suitable buckets, which shall alternately dip into the water contained in said reservoir, and convey the same into the main reservoir, thereby maintaining a correct water-line under all ordinary circumstances, and effecting an equitable registration of gas. It consists, secondly, in preventing the metre from being overcharged, by the employment of a pipe extending up near the water-line, and communicating from the supply reservoir to the bottom of the dry well in front of the metre, so that should any attempt be made to overcharge the reservoir, the water will escape through this pipe, and rise into the dry well and stop the flow of gas completely. Also, in a peculiar arrangement of the water inlet pipe, so that it will have no communication with the body of the metre.]

95. HORIZONTAL WATER-WHEELS; A. M. Ford and C. W. Warner, Jericho, Vermont.

Claim—The construction and arrangement of the lifter and band, and of the buckets, combined in the manner set forth.

96. AXLES OR SHAFTS; George Foster, Brooklyn, New York.

Claim—A shaft or axle, cellular in its character and composed of a series of wrought iron rods or tubes, covered and held together by a casting cast upon the same, and forming the journal wheel, bearing section wheel, and pulley.

97. MOLE PLOUGHS; W. P. Goolman, Dublin, Assignor to self and Samuel B. Morris, Wayne Co., Indiana.

Claim—1st, The lever, rigidly attached to a pivoted mole in the described combination with the rack, arranged and operating as set forth. 2d, The cam, in the described combination with the coulter and adjustable pivoted mole, operating as set forth.

98. PRESERVING FLESH AND MEATS; Magnus Gross, Washington City, D. C.

Claim—The application of an air-tight apparatus of displacement to which hydrostatic pressure is applied, for the purpose and in the manner set forth.

99. STICKS FOR EXHIBITION ROCKETS; Charles Hadfield, Brooklyn, New York.

Claim—The rocket stick enclosing or in connexion with a magazine of powder, in the manner set forth.

100. CANDLE MOULDS; H. Halvorson, Cambridge, Massachusetts.

Claim—The combination with an outer tube of the inner elastic slit tube, applied and operating as set forth. And in combination with the elastic tube, I claim the tip of elastic or yielding material, applied and operating as described.

101. WASHING MACHINE; Ira Hann, Hope, New Jersey.

Claim—The combination of the fixed rubber board with the removable rubber, friction roll, presser carriage, and operating lever, arranged as described.

102. BEE-HIVES; J. S. Harbison, Sacramento, California.

Claim—Placing the bee comb, known as worker cells, in a horizontal, or nearly horizontal position, so that the cells shall be vertical, or nearly vertical, instead of horizontal, by the means as set forth.

103. BUTLER'S TRAY; William Hoffman, Benicia, California.

Claim—A single-handed butler's tray, furnished with a hinged or pivoted handle, so as to be detached or swing out of the way, to facilitate the placing or removing of articles upon it, and to economize room and space in carrying or stowing it away.

104. RATCHET PULLEYS FOR BLIND CORDS; J. B. Holmes, Jr., City of New York.

Claim—The metallic bar projecting from the window casing, and having teeth on the back thereof, in combination with the bridle pawl passing around said bar, and carrying the pulley for the cord. Also, the porcelain roller on the centre-pin, in combination with the bridle pawl and bar.

105. CLAMPS FOR METAL STRAPS; A. H. Hook, City of New York.

Claim—The outer griper and nail for fastening the ends of bale and other straps, constructed as set forth.

106. Hoop Locks; Daniel Hughes, Rochester, New York.

Claim—The case or box, having slots in two opposite sides, and provided with a clamp or jaw, arranged as set forth.

107. Boots; Peter Keffer, Reading, Pennsylvania.

Claim—The described mode of making the leg of the boot, the leather being folded in front, and the crimp hammered in, instead of crimping in the usual way, and the ankle being completed by a single seam and one piece of leather, as set forth.

108. Harvesters; L. G. Kniffen, North Salem, New York.

Claim—Constructing, as a whole, the shoe on which the cutter and finger bars are supported and adjusted in one piece, combining the guide box for the cutter bar, the recess for the finger bar, the slotted bracket for the castor wheel to be attached to the vertical locking portion, the vertical pivot or gudgeon, for the whole to be suspended or adjusted on horizontally, to a position parallel with the inner side of the main frame, as set forth.

109. Metallic Window Blinds; G. A. Lathrop, East Saginaw, Michigan.

Claim—The arrangement of the plate with slots, slats or water-sheds, and grooves, in combination with the slotted slide, as specified.

110. Seed Planters; J. A. Lee, Camanche, Iowa.

Claim—The arrangement of the bar, r, cord, rotary shaft, sliding seed-box, bars, c, lever, and sliding axle, as described.

111. Apparatus for Moulding Candles; Horatio Leonard and Henry Ryder, New Bedford, Massachusetts.

Claim—Making the receiver or trough separate from the body of the mould or series of moulds, and so constructed and arranged as to operate therewith, in the manner set forth. Also, the described improved mode of packing the lower orifice of the mould, viz: by means of a spring furnished with rubber or other proper elastic material, the same being arranged and made to operate with respect to the said orifice, as set forth.

112. Machine for Cutting Railway Bars; Benjamin A. Mason, Newport, Rhode Island.

Claim—For giving to rails the form described, the combination of the series of cutters, arranged in relation to each other, as described.

113. Corn Planters; O. C. McCune, Darby Creek, Ohio.

Claim—The arrangement of the peculiarly formed rack bar rod, bent lever, pawl, ring, cam, and arm, as described.

[This invention consists in placing in rear of the plough, used to form the furrow in which the corn is deposited, a shovel or coverer, and in operating the same by suitable connecting rods and levers, so as to cover the corn in hills, after being deposited in the furrow.]

114. Vegetable-slicer; Chauncey Parmelee, Wilmington, Vermont.

Claim—Supporting the front end of the adjustable plane of bottom on the fixed bottom board of the hopper, so that it shall be stationary relatively to the gate, and arranging at the end of the plane the mechanism for raising it. Also, the application of the board or partition to the hopper and the adjustable platform, in the manner specified.

115. Spectacle Frame; William H. Peckham, Hoboken, New Jersey.

Claim—Connecting the end pieces of spectacle frames by the clasp sockets, in the manner specified.

116. Method of Protecting Frictional Electric Machines from Moisture; Charles A. Seeley, City of New York.

Claim—Enclosing an electrical machine in a covering or box, which is nearly or quite air-tight, and, by means of an absorbent moisture, preserving the air about the machine nearly uniformly dry. Also, the insulating covering or box, as described.

117. Nut Machines; Andrew J. Shepard, Buffalo, New York.

Claim—1st, Perforating the punch, e, as described. 2d, The cutters, constructed and arranged relatively to the dies, as described. 3d, The combination of the dies with the water chambers, l and m, arranged as described. 4th, The combination and arrangement of the punch, d, with the water chamber, 7, and openings, as described.

118. Attaching Spokes of Carriage Wheels; Joel Y. Schelly, Hereford, Pennsylvania.

Claim—1st, The ferrule, furnished with rings, and applied in the manner set forth. 2d, The screw plates, welded upon the inside face of the tire, in the manner set forth. 3d, The combination of (with suitable slots made in the inside face of the tire,) the bolt, e, key-bolt, g, and plate, arranged in the manner specified, for securing the tire rigidly in its place upon the wheel.

119. Manure Drills; G. B. Singeltery, Greenville, North Carolina.

Claim—The arrangement of the plough, guide board, lifting bar, guiding bar, and rotating hopper or receptacle, as described.

120. Hemp-breaking Machines; Stephen Stafford, Carrollton, Missouri.

Claim—Constructing the brake with two discs and heads, and uniting said discs by means of rounds or slats armed with obliquely-set teeth, and arranged so that spaces shall exist between them, and they can be adjusted to give the teeth any required obliquity, as set forth.

121. Watch Keys; John F. Sterling, San Francisco, California.

Claim—A watch or door key with a hollow stem or pod, open at both its ends, so that anything getting into it that would obstruct its action will drop or be punched out through the open stem.

122. Belting for Pulleys; Euclid C. Thayer, Providence, Rhode Island.

Claim—The manufacture of round belting by preparing the leather, or other material, in the mode described, and rolling and twisting the same in a spiral form with any required number of conical layers in the cylinder, either with or without a cylindrical space in the centre of the belt, and cementing the layers in the process of manufacture, as described.

123. Bee-hives; T. S. Underhill, St. Johnsville, New York.

Claim—1st, The arrangement of the movable frame, in combination with the sliding hive and adjustable side, as set forth. 2d, The arrangement of the adjustable boards placed on a frame, when said parts are constructed as described, and used in connexion with the sliding hive, for the purpose specified.

121. HAND CAR FOR RAILROADS; Antony Welsch, Chicago, Illinois.

Claim—The movable platform, and the attachment thereto of the crank and wheel, in the manner set forth.

125. DISPENSING WITH SWITCHES ON RAILROADS; William Wharton, Philadelphia, Pennsylvania.

Claim—The employment of a car wheel, provided with one or more treads in addition to the ordinary tread, upon either the outer or inner side of said ordinary tread, and of the same or different diameter as said ordinary tread, in combination with additional raised rail or rails with a gradual rise, either curved or straight, so placed that such of the said extra treads as desired shall be caused to run upon them, thereby raising the car entirely clear of the ordinary track, and causing it to follow the direction of said raised rail or rails, whether curved or straight, for the purpose of avoiding the necessity for railroad switches, arranged as set forth.

126. SEED PLANTERS; Wm. H. Worth and Leonard Finlay, Canton, Missouri.

Claim—The arrangement of the longitudinally moving slotted plate, vertical gate, sliding bar, operating lever, shoes, and rotary coulters, as described.

[The nature of this invention consists in the arrangement of rotary cutters placed before the shoes for forming the drill, and hung upon a pivoted frame in such manner that they will conform to the irregularities of the surface of the ground in the operation of planting the corn. It also consists, in connexion with a reciprocating seed slide for depositing the seed in the shoe, in arranging a vertical gate, working in the heel of the shoe, and operated by means of a peculiarly slotted piece fixed to the seed slide, so as to deposit the seed in the drill from the shoe at regular and required intervals along the line of the furrow; the corn being retained in the heel of the shoe until the lever is moved back ready to receive another charge of seed.]

127. SEED PLANTERS; Henry Bell, Assignor to Fenton F. Bogar and Joseph W. Tidball, Clinton, Illinois.

Claim—1st, The arrangement and combination of the rock shaft, cog segments, pinion, crank shaft, ratchet bars, springs, feed slide, and discharge regulating valve, arranged and combined in the manner set forth. 2d, In combination with the above, the arrangement of the treadle and hand lever, together and on the same fulcrum, so that the feed slide can be worked either by the hand or foot, as set forth. 3d, The combination with the foregoing peculiar arrangement of parts for dropping the seed, the arrangement of a b c d, for regulating the depth of the furrow-openers, as set forth.

128. REVIVIFYING BONE BLACK; Wm. Bellows, Assignor to self and Charles W. Smith, Cincinnati, Ohio.

Claim—1st, An apparatus for revivifying bone black arranged and constructed as described. 2d, The flarening bottoms of the retorts, arranged and combined with the described apparatus, for the purpose specified. 3d, The flanches, in combination with the retorts, for the purpose of allowing for expansion and contraction and replacing of retorts, as well as protecting internal heating surface, as described. 4th, The chamber between flanches and lower plates, for the purpose of preventing undue radiation of heat, and for the purpose of passing off the offensive gases arising from retorts when said chamber is combined with flanches and cover plates, for the purpose described.

129. HYDRO-CARBON VAPOR APPARATUS; George H. Bronson, Assignor to self and David Millard, Cincinnati, Ohio.

Claim—The arrangement and combination of the zigzag folded surfaces extending over the projecting edges, F, with the projecting edges, E C C C C, &c., in each of the several cells or chambers of the impregnating apparatus, in the manner set forth.

130. CHURN; Mortimer S. Harsha, Assignor to self, Rufus S. Sanborn, and H. B. Jones, Sycamore, Illinois.

Claim—An entirely stationary brake-dash, in combination with a cream-receiver, made to rotate on a vertical or upright shaft, as described.

131. GRAVEL CARS; Thomas C. Hendry, Assignor to self, J. Dillworth, and F. E. Askin, Conyers, Georgia.

Claim—The combination of the double inclined bottom and swinging doors, the latter being operated by the rods, bar, and lever, as set forth.

132. CONNECTING ELLIPTIC SPRINGS TO VEHICLES; James W. Lawrence, Assignor to self, Henry Brewster, and John W. Britton, City of New York.

Claim—The manner of combining and securing the back axle and the elliptic spring, as described.

133. SEWING MACHINES; Charles Miller, Assignor to George Ricardo, City of New York.

Claim—1st, The combination with the shuttle-driver of the releasing plate and lifter, as described. 2d, The employment of a shuttle made of two springs, in the peculiar manner described, in combination with the bobbin.

[This invention consists in the employment, in combination with a feeding dog operating below or at the back of the material being sewed, with a simple reciprocating rectilinear motion parallel with the surface of the material, and a presser acting on the top or in front of the material to press it against or towards the teeth or face of the dog, of a plate, which may be termed a releasing plate, arranged on the same side of the material as the dog, and having a movement in a direction perpendicular, or nearly so, to the face of the material, for the purpose of lifting the material and keeping it released from the dog during the backward movement of the latter. The invention also consists in effecting the releasing movement of the said releasing plate by means of a wedge-like projection, or its equivalent, formed upon or carried by a shuttle-driver.

134. SHINGLE MACHINES; E. R. Morrison, Assignor to S. C Hill, Brooklyn, New York.

Claim—1st, The arrangement of the knife, H, and projection, V, in connexion with the reciprocating bed, whereby the bolt is supported as the bed passes underneath it during the cutting or riving operation. 2d, The employment or use of the planers or knives, C C, operated by the plates, bar, and ledge or projection, F, on the bed, as described.

DECEMBER 20.

135. APPLE-PARER, CORER, AND SLICER; John I. Armfield, Jamestown, North Carolina.

Claim—The combination of the two levers, B C, connected by the link, one lever, B, being provided with the cutter, and the other lever, C, having one end fitted on the arbor, as set forth.

136. CATTLE PUMPS; John Augspurger, Trenton, Ohio.

Claim—1st, The combination and arrangement of the platform, levers, springs, weights, rods, and brake wheels, operating as set forth. 2d, The arrangement of the float, rod, and valve, in the described combination with and relation to the bucket and hinged platform, operating in the manner explained.

137. LOCOMOTIVE TRACTION VEHICLES; John H. Bailey, Sand Ford, Indiana.

Claim—1st, The means employed for rotating or communicating power to the wheels, D D, to wit: the fixed pinion, p, on the shaft, loose or sliding pinions, q q, wheels, s, pinions, v, and toothed rims, as described. 2d, The combination of the wheels, J D D, when applied to a traction engine, and arranged for joint operation, as set forth.

[This invention is more especially designed for agricultural purposes, such as the drawing of gang ploughs, harrows, seeding machines, &c. The invention consists in a peculiar arrangement of the driving gear, and the manner of applying the power thereto, whereby the machine is placed under the perfect control of the driver or attendant.]

138. BLANKETS FOR PRINTING; S. W. Baker, Providence, Rhode Island.

Claim—A rubber or gutta percha, or other elastic printing band or blanket, having either roughened selvages or margins, or the whole of its surface roughened, as set forth.

139. WRENCH; A. J. Bell, Greenupsburgh, Kentucky.

Claim—The combination of the jointed lever, wedge, and tooth, with the sliding jaw and bar, as described.

140. HOISTING MACHINES; Albert Betteley, Boston, Massachusetts.

Claim—1st, Bringing the car to a stop whenever (while in motion) its door may be opened, by causing the shipper rope to be pinched or held, as described. 2d, The arrangement, substantially as specified, for causing the car to be stopped at proper times and places, said arrangement consisting of cam, spring, levers, operating together and upon the shipper cord.

141. ARRANGEMENT FOR SUPPLYING AIR TO THE FURNACES OF STEAM BOILERS FROM THE WHEEL-HOUSES OF STEAMERS; Louis Brandt, Indianola, Texas.

Claim—Supplying air under pressure to the furnace or furnaces of steamers, by means of the paddle-wheel and the peculiar curved pipe with water escape passage leading from the casing or housing of the same to the fire, or under the grates of the furnaces, as set forth.

142. CORN SHELLERS; B. Bridendolph, Clear Spring, Maryland.

Claim—The differential feeding and shelling screw, constructed as described, in combination with the spout or trunk and face wheel, arranged and operating together in the manner described.

143. WAGON BRAKES; Robert D. Brown, Prattsburgh, New York.

Claim—The combination and arrangement of the brake mechanism, lever, and connecting rod, when the latter is attached directly to the front axle, so as to be operated by the backward movement of the front truck; the said movement being allowed by the slot in the reach or coupling bar, and the roller in the bolster.

144. SKIRT SUPPORTERS; Henry F. Brown, Chagrin Falls, Ohio.

Claim—An improvement in the supporter aforesaid, by connecting the hoops or bands by a clasp or inflexible joint.

145. COAL-SIFTERS; Joseph P. Buckland, Chicopee Falls, Massachusetts.

Claim—1st, A dumping or tipping sieve provided with a movable tail-piece or gate, so arranged that the tipping or slanting of the sieve causes the opening of the end or side of the same, for the free passage of the coal or other substance sifted. 2d, A combination of the scrolls and cams with the sieve, arranged in the manner described.

146. BREECH-LOADING FIRE ARMS; Bethel Burton, Brooklyn, New York.

Claim—The construction and relative arrangement of the breech-supporter with the sliding breech, sectional screw, guide slot, and pin, as set forth.

147. HOLD-BACKS; R. W. Carrier, Sherburne, New York.

Claim—The combination and arrangement of the open hold-back loop or eye, pivoted lever stop bar, which has an extension or heel on its lower end, and the flat spring, as set forth.

[This invention relates to an improvement in the metal loops or eyes that are attached to the thills of vehicles, to receive the straps of the harness by which the vehicle is held back in descending hills. The invention consists in having the loops or eyes provided with yielding bars or studs at their front sides, so that the straps may detach themselves as the horse passes out of the thills. The object of the invention is to allow the horse to be readily detached from the vehicle when necessary, and not permit the hold-back straps, as hitherto, to form a positive connexion with the thills, which is a fruitful source of accident.]

148. GATE; S. W. Chamberlain, Three Oaks, Michigan.

Claim—The arrangement and combination of the gates, posts, arms, links, and levers, in connexion with the cords, constructed as set forth.

149. ATTACHING HANDLES TO CUTLERY; Mathew Chapman, Greenfield, Massachusetts.

Claim—Securing handles to cutlery and other tools or implements, by having a screw thread formed on the tangs, and provided with plane longitudinal surfaces in connexion with the cylinder or nut fitted in the handle, and hammered or compressed to fit the screw and its plane surfaces, as set forth.

150. CONSTRUCTION OF VAULT LIGHTS; John B. Cornell, City of New York.

Claim—Producing an improved illuminating plate by the process of combining the illuminating and metallic portions of said plate with each other, in the manner set forth.

151. STEAM VALVES; C. W. Corr, Carlinville, Illinois.

Claim—1st, Providing the extremity of the driving shaft within the steam chest, with a slot to receive the head of the valve stem, and permit the self-adjustment of said head within the slot. 2d, The arrangement of the screw threads upon the valve and valve stem, so that the valve will adjust itself if the friction becomes too great.

152. APPARATUS FOR PRESERVING GRAIN; Louis Michel François Doyere, Paris, France; patented in France, March 28, 1854.

Claim—The method of constructing or arranging air-tight chambers or granaries for the preservation of corn and other grain, as described.

153. STONE-LOADING WAGONS; Nathaniel Drake, Newton, New Jersey.

Claim—The employment or use of the shaft with one or more drums placed loosely on it—the shaft and drums being provided with ratchets, in combination with the pawls and the adjustable bar, provided with the pulleys, the whole being applied to a mounted frame, and arranged as set forth.

154. ANTI-FRICTION BOXES; Joseph L. Dutton, Sr., Philadelphia, Pennsylvania.

Claim—Interposing between a revolving and stationary surface any convenient number of beveled anti-friction rollers, so formed that the portion of each roller on which the revolving surface bears shall be larger in diameter than the portion or portions of the roller which bear on the stationary plate.

155. PLATFORM SCALES; Thaddeus Fairbanks, St. Johnsbury, Vermont.

Claim—The arrangement and application of the yoke stirrups, their concave steps or bearings, and the pivots of the two multiplying and transmitting levers, as specified. Also, combining with the rod and the yoke applied thereto, as described, the cap or bonnet, being for the purpose specified.

156. PLATFORM SCALES; Thaddeus Fairbanks, St. Johnsbury, Vermont.

Claim—Supporting the fulcrum of a transmitting lever by the platform or an extension therefrom, as specified. Also, the combination of the rocker block with the stirrup link, and the bearing pins or knife edges of the connected levers, as described. Also, constructing the platform frame with the passages through each of its end timbers, and for the reception of the inferior arms of the multiplying levers. Also, providing such platform with loop passages leading downward out of the lever passages made in the end timbers, as described.

157. PIPE MOULDING; John Firth and John Ingham, Phillipsburgh, New Jersey.

Claim—1st, The employment or use of the flexible elastic ring, in connexion with the body pattern, flasks, and bottom plate, for the purpose specified. 2d, Blackwashing the moulds by means of a brush, or an equivalent device, supplied with the blackwash and passed through the moulds, as set forth.

158. SCREW TAPS; Wm. and Robert Foster, City of New York.

Claim—The combination of the oblique-backed taps and slotted collar, with the tapering or conical stock, so that on turning the collar the cutting threads of the taps will be released from the nut, and thus allow the tool to be withdrawn.

159. BELT-FASTENINGS; William Frazier, Hartford, Connecticut.

Claim—The arrangement of duplicate plates, A B, of raw hide, or other flexible or suitable material, and in providing one (or both) of the plates with metallic hooks, which hooks are made to pass through the perforations in the belt, and in the plates, A or B, to connect and hold the two ends of the belt together (in contradistinction for the use of the metallic plates, screws, lace-leather, &c).

160. MANUFACTURE OF CAOUTCHOUC BELTING; Dennis C. Gately, Newtown, Connecticut.

Claim—The method described of manufacturing belts or bands of india rubber or gutta percha, consisting in placing them in contact with sheets or strips of paper or cloth, having a smooth enameled or polished surface, and then heating them, as described.

161. STEAM EXCAVATORS; W. G. Goodale and R. L. T. Marsh, Centralia, Illinois.

Claim—1st, The combination, with a locomotive steam engine, of an earth elevator and suitable earth receptacles, so that the machine may be moved by its own power, under the guidance of an attendant, to the spot to be excavated; then be made to load itself and transport the load to the desired place for discharge, in the manner set forth. 2d, The combination with an excavating machine, made as set forth, of a railroad track, as shown, with or without the turn-tables.

162. SKIRT-SUPPORTERS; D. B. Hale, City of New York.

Claim—The waist, in combination with the extension expanded by the insertion of hoops, having their ends connected by tying them and forming entire circles, in the manner set forth.

163. CHAIRS FOR RAILROADS; Hayward A. Harvey, City of New York.

Claim—Forming the chair with lips extending over the web or base of the rails, and with a groove, or equivalent reception for a wedge—but this I only claim when combined with a wedge to be driven across the longitudinal plane of the rails, and passing under the base of the two rails to force and hold them up against the lips of the chair, and to form a base or rest for the base of the ends of the two sections of rails to rest on, as specified.

164. SHOES AND GAITERS; Alexander Hay, Philadelphia, Pennsylvania.

Claim—Inserting in the shoe or gaiter, at the points where it is to be fastened, a piece or pieces of elastic rubber cloth, for the purpose of fastening the shoe or gaiter with hooks and eyes, or buttons, or buckles, as described, and thereby dispensing with shoe strings.

165. DOOR-FASTENER; George V. Hazard, Torrey, New York.

Claim—The part, A, constructed and arranged as set forth.

166. RAT-TRAP; Simpson S. Henderson, Oxford, Ohio.

Claim—The combination of the springs with cone spools, catch, detent, and bait wire, forming the trigger and striker, the whole operating in the manner set forth.

167. CLOTHES-DRYER; D. K. Kickok, Morrisville, Vermont.

Claim—The internally-grooved hub and spring catch, in combination with hollow-headed shaft, headed pin, and securing cord, as set forth, when arranged with hub, braces, arms, and cord.

168. HYDRO-CARBON VAPOR APPARATUS; Levi L. Hill, Greenport, New York.

Claim—The combination, with a vaporizing vessel, of the bellows, air receiver, and eduction pipe, as shown, or in an equivalent manner.

169. STUMP EXTRACTORS; Edwin Hosmer, Bedford, Massachusetts.

Claim—The improved lever and hook stump extractor, as constructed, with the combination of the holding tongue and its supporter, and with each united by a universal joint, in manner specified.

170. MACHINE FOR CUTTING PAPER; Thomas W. Houchin, Worcester, Massachusetts.

Claim—The combination and arrangement of the knife, slides, and connecting bar, with coupling arms, eccentrics, and shaft, as set forth.

171. IRON PLATE JAIL; Enoch Jacobs, Cincinnati, Ohio.

Claim—In the construction of jails and prison houses, the improved iron walls for the same, consisting of the following parts, arranged and united as set forth, to wit: the entire wall plates, A, having their edges closely abutting the joint plates, united to and uniting the plates, A, by rivets, which have their riveted ends inwards, and counter-sunk to the depth of the thickness of the plates, A, in the manner set forth.

172. GRAVING DOCKS; Wm. A. Kenrick and George H. Whitcher, Boston, Massachusetts.

Claim—The floating dock and the stationary receiving basin or tank, in combination and as furnished, not only with one or more connexion pipes and gates for the discharge of water from the dock into the tank, or vice-versa, but with one or more passages and gates arranged in the tank, so as to either discharge water therefrom into the sea, or admit it to pass from the sea into the tank. Also, the elevating slide, in combination with a connexion pipe of the dock, and a deep opening made in the tank, the said slide being arranged therewith, and connected with the dock, as specified.

173. CAR TRUCKS; Henry Kipple and Jacob D. Bullock, Philadelphia, Pennsylvania.

Claim—The bolster and platform, with the intervening springs of any suitable construction, in combination with the inclined links, their sockets, and the pins, arranged on the truck, as set forth.

174. PIANO-FORTES; John G. Kunze, City of New York.

Claim—1st, Supporting the bridge on columns or distance pieces, to admit any number of braces for the hitch plate, between the strings and the top of the sounding board, and likewise to admit of a greater vibration of the sounding-board, in the manner described. 2d, The arrangement of additional braces to the hitch plate, situated between the strings and the top of the sounding-board, and connecting said braces with the braces or the wooden truss-work situated between the frame, in the manner set forth. 3d, The application of a bottom sounding-board when in connexion with a lower metallic frame or hitch plate covered with strings, in the manner described. 4th, The elastic spring brace to connect the two sounding-boards together, for the purpose described. 5th, The arrangement of the strings in two rows, with the use of a curved hammer line, in piano-fortes where the action strikes the strings from above downwards.

175. BREECH-LOADING FIRE ARMS; Richard S. Lawrence, Hartford, Connecticut.

Claim—1st, The combination of the detachable plate, between the barrel and the sliding breech, with the expanding ring, as set forth. 2d, In combination with the sliding breech and plates, I claim the hollow nipple situated in the centre of the gas chamber, and projecting forward nearly or quite to the face of the breech, as set forth.

[This invention relates to that description of breech-loading fire arms which have what is commonly known as the "sliding breech." It consists in making the sliding breech of two pieces—one of which pieces, constituting the entire back of the breech, has in it a cylindrical cavity larger than the bore of the barrel, and the other of which, constituting the entire face, has a counter-sunk projection which enters and fits the said cavity in such a manner that the said projection combines with the said cavity to form a gas chamber in the rear of, and of larger bore than the barrel, and communicating with the barrel by a suitable opening in the front part of the breech, which admits the gases into the said chamber at each discharge, to force apart the two pieces of the breech, and cause the front pieces to form a perfect gas-tight joint with the rear end of the barrel; and thus, while preventing any loss of the explosive force, preventing the corrosion of the face of the breech, and permitting it to slide with perfect freedom after frequently and quickly repeated firing. It further consists in the employment, in combination with the so constructed breech, of a hollow cone situated in the centre of the cavity of the rear portion of the breech, and projecting nearly even with the front face of the breech, for the purpose of communicating the fire from the cap or other priming to the cartridge or charge in an exact line with the centre of the bore of the barrel.]

176. STAVE MACHINES; James Little, Evansville, Indiana.

Claim—The adjustable bed, in combination with the rod and lever, arranged to operate as set forth.

177. WATER TRAPS; James A. Lowe, City of New York.

Claim—The water trap shown, when cast without a seam (in lead or composition).

178. FERTILIZERS; James J. Mapes, Newark, New Jersey.

Claim—The production of the fertilizers for soils, by the combination of dried blood with the compound which I have herein specified as my improved superphosphate of lime, or any equivalent therefor, substantially the same.

179. CLASP FOR HITCHING STRAPS; M. R. Margerum and T. P. Marshall, Trenton, New Jersey.

Claim—The arrangement of the hole and the key, in combination with the sliding part for fastening hitching straps, as described.

180. WOOD SCREWS; Charles Millar, Utica, New York.

Claim—The construction of wood screws having a shank, or that portion of the wire lying between the thread and the head of the screw reduced in its diameter, so that, without any enlargement of the orifice beyond that made by the stem, the screw may be driven home without increase of friction at the shank, and without injury to the screw or to the hold thereof upon the fibres of the wood, as described.

181. WASHERS; George Miller and Caleb M. Andrews, Providence, Rhode Island.

Claim—A washer, constructed of a leather strip wound in coil form, and with or without the interposition of other substances between its convolutions, as set forth.

[This invention consists in forming the washers by winding leather strips of any convenient width in coil form, whereby the sides or faces of the washers present the grain or fibre of the leather endwise to the running or working surfaces of articles to which they are applied. The convolutions of the leather may be connected by cement; and, in certain cases where necessary, soft metal plates or other suitable substance may be interposed between the convolutions in order to protect the leather from wear.]

182. SHUTTLES FOR SEWING MACHINES; G. W. Mitchell, Jackson, Tennessee.

Claim—The shuttle, formed with an open cavity through it in a transverse direction to its movement, with the bobbin to fit the cavity, the heads of the bobbin forming a part of the sides of the shuttle, and being kept in position by the sides of the shuttle race or carrier, as described.

183. PLATFORM SCALES; Amos B. Morey, St. Louis, Missouri.

Claim—The specific arrangement of the braces with the lever and the head, as described.

184. NAIL PLATE-FEEDER; John Newell, Lowell, Massachusetts.

Claim—1st, In combination with a magazine for containing a pile of plates, an automatic driver that takes the under plate of the pile, and feeds it up toward the cutters in regular succession, as described. 2d, In combination with the automatic driver, the geared hub and segment, and hinged lever, R, for turning and moving the nail plate to the driver and to the cutters, as described. 3d, In combination with the driver or the carriage to which it is connected, the lever, S, with its several connected parts, for throwing out and holding out of gear the feeding devices, while the driver is in the act of bringing up a fresh nail plate. 4th, In

combination with the feeding shaft and its grooves, the pivoted switch on the carriage, for the purpose of giving said carriage a rapid rotating and partial advanced motion, and a slow feed motion.

185. SKELETON SKIRTS; Cæsar Neumann, City of New York.

Claim—The spring joint or hinge, arranged as specified, by which the hoops can be contracted and expanded, in the manner set forth.

186. PRESERVE CANS; Carlton Newman, Birmingham, Pennsylvania.

Claim—The use of the loose or detached elastic band, when used in connexion with the flaring rim or lid, rib or ridge, and groove, in the neck of the jar, or the equivalents of said rim, ridge, and groove, arranged as described.

187. COTTON GINS; D. G. Olmsted, Vicksburgh, Mississippi.

Claim—1st, Feeding the cotton into the roll box through a hulling grate, so as to exclude the principal hulls and trash, while the seed cotton is admitted. 2d, The projections at the intersection of the ribs of the ginning grate, and extension, for the purpose of directing the cotton past the seed space at the lower edge of the hulling grate, in combination with said grate. 3d, The arrangement of the air-directing partition, constructed as described, in combination with the hatchel cylinder, for the purpose specified, at the same time disclaiming its use in any other manner or connexion. 4th, The extensions, when arranged as continuations of the brush wings, around the ends or heads of the brush cylinder, for the purpose specified—while I disclaim the use of wings or fans on the ends of the brush cylinder unconnected with the brush wings.

188. PIPE COUPLINGS; Charles G. Page and Ralph J. Falconer, Washington City, D. C.

Claim—Combining the lateral or transverse movement of the male and female sections with an endwise movement, to effect the tightening of said sections, as set forth.

189. DOOR BOLTS; Charles Grafton Page, Washington City, D. C.

Claim—The locking of bolts, when bolted or shut, by means of rotary handles moving with the bolts, and operating upon the principles set forth.

190. MANUFACTURE OF RUBBER ARTICLES; Du Bois D. Parmelee, Salem, Assignor to John A. Greene, Beverly, Massachusetts.

Claim—The employment, in the manufacture of india rubber sheets, whether combined or not with cloth, and when the same are to be treated in the cold way to effect the change, as described, on either side of the tank containing the hermizing solution, of a feeding mechanism, so arranged and operated that the sheet may be fed in and out of the tank at a uniform rate, and free from injurious handling and draft or strain, in the manner set forth.

191. MACHINE FOR FORMING HUBS; William Patterson, Constantine, Michigan.

Claim—In combination with the swivel nut having a yielding or spring seat, the adjustable collar, and cutter shaft for causing the cutter to form a shoulder in the hub, in a plane parallel to the end of the hub, while the cutter is carried and fed by an inclined screw shaft, as described. Also, the combination of the guiding spring bar and its adjusting screws with the slide, centre disc, and cutter shaft, for the purpose of boring out the interior of the hub and cutting off the ends of the spokes, and thereby prevent the latter from resting and pressing unequally on the box or on the exposed part of the axle.

192. HEATING APPARATUS; Calvin Pepper, Albany, New York.

Claim—The use of fine silicious sand for radiating heat according to the application thereof, as described, the radiation being principally from the sand, and the radiation from the sand coming from between the meshes of the fine wire gauze screen, or the openings of minutely perforated metal, or other solid substance, the metallic gauze or perforated metal being used for the purpose of retaining the sand while admitting radiation through its meshes, and the sand being heated by the fuel of wood, coal, gas, burning fluid, or other fuel, or from hot metal, hot air, hot water, or steam in stoves, tubes, conductors, or other heating apparatus, substantially as described, and subject to the disclaimer and exceptions as stated.

193. STOVES; Albion Ransom, Albany, New York.

Claim—The application to and use with sheet or thin metal stoves, of an independent hood flue formed and fitted for attachment to such stoves, as described, and for the purposes set forth.

194. RAILS FOR STREET RAILROADS; Abraham Reese, Pittsburgh, Pennsylvania.

Claim—Making iron rails for street railroads of the shape substantially as described, having on each side a head or projection at one edge of the rail, with a flat base extending from the projection or head to the other side, both sides or faces being finished alike, so that the rail may be used either side up, and reversed when one side is worn out.

195. GOLD-WASHER; Celestin Ringel, San Francisco, California.

Claim—The combination of a water-wheel with a separating or reducing machine into one apparatus, by using the inner space of a wheel partly or wholly inclosed as a receiver, dispensing in this manner with couplings or connexions, and with a second vessel or receiver, which would have to be set in motion by the water-wheel.

196. STEREOSCOPIC APPARATUS; T. C. Roche, City of New York.

Claim—1st, The employment of a skeleton wheel, as described, for the purpose of bringing the pictures before the eye glasses. 2d, Placing the pictures together back to back, and so that one is upright when the other is upside down. 3d, In combination with the chain of pictures, I claim the arrangement of the sliding partition and door, on the side and near to the bottom of the box, as set forth.

197. BREECH-LOADING FIRE ARMS; J. Hunter Sears, Brantford, Canada West.

Claim—Combining and applying the hinged breech-piece and the breech screw, as specified, so that the force applied to a lever attached to the screw may serve to first withdraw the screw, and afterwards throw out the breech-piece.

198. WORKING BUTTER; Josiah Seymour, Coventry, New York.

Claim—The construction and arrangement of the tray to retain the fluids when desired, in washing and working over butter. Also, the manner of securing the tray to the platform or table, so as to be easily tipped up to drain off the fluids in cleansing, the detachable arch frame, and rounded wedged-shaped butter-worker for spreading thin while salting, all in combination, as specified.

199. SHIPS' STOVES; George W. Slater, New Haven, Connecticut.

Claim—Forming the joints of the thimbles and sockets, attached respectively to the swinging flue, stove, and stationary flue, as set forth.

200. SURFACE CONDENSERS FOR STEAM ENGINES; Ananias Smith, Niagara Falls, New York.

Claim—1st. The employment, in connexion with a steam engine and its boiler, of a revolving bucket wheel, arranged to receive the exhaust steam from the engine, and made to rotate in a reverse direction to its issues in a cylinder or vessel containing water, from which the boiler of the engine is fed, the exhaust steam being condensed by direct impingement with and adding to said feed water. 2d. The combination with the revolving bucket or wheel constructed to receive the exhaust steam from the engine and cylinder, or vessel containing the condensing liquid or feed water in which the wheel rotates, and by direct contact with which water the exhaust steam is condensed, in the manner described, of a surface cooling apparatus, formed by providing said feed water vessel with a jacket or tubes, or their equivalents, through which a cooling liquid is made to pass or circulate, free from admixture with the water in the vessel, that directly effects the condensation of the steam.

201. PIPE-NIPPERS; George Smith, City of New York.

Claim—The combination with the slotted lever of the movable claw, grooved pin, and holding spring, so that the claw may be readily removed from one side of the lever to the other, thus forming a right or left-handed instrument at pleasure, as set forth.

202. LEVER ESCAPEMENT FOR TIME-PIECES; Nathan Spicer, St. Paul, Minnesota.

Claim—The combination of the two sets of teeth on the escape wheel and the single pair of pallets, or their equivalent, with two or more forks on the lever, operating upon and operated upon by a single pin or cylinder attached to the balance, operating as set forth.

203. GRAND PIANOS; Henry Steinway, City of New York.

Claim—The arrangement of the strings of the lower notes, and those of the higher notes of a grand piano-forte, as described.

204. DEVICE FOR FEEDING THE BOLT IN SHINGLE MACHINES; Oren Stoddard, Busti, New York.

Claim—The ratchets attached to the feed shafts, provided each with alternate long and short teeth, and operated by the pawls and slide from the knife-gate or frame, in the manner specified.

205. INVALID COUCH; C. L. Maillant, City of New York.

Claim—The method of constructing an invalid couch, arranged in the manner set forth.

206. MAST-SCRAPER; Robert N. Tate, New London, Connecticut.

Claim—An implement or tool, composed of a steel plate, provided with one or more concave edges, and attached to a suitable tang or handle.

207. SEWING MACHINES; Joseph Thorne, City of New York.

Claim—The specific arrangement of parts described, for giving the appropriate motions to the needle-bar and to the shuttle-driver.

208. THREAD TENSIONS FOR SEWING MACHINES; E. L. Pratt, Philadelphia, Pennsylvania.

Claim—Separating and holding the coil at the openings through which the thread passes in and out from between it and its fellow or support, by means of the strips, or their substantial equivalents, for the purpose of allowing a free passage of the said thread without causing friction on the openings, and for the better adjusting or changing the thread whilst the spring remains at the proper working tension, as described.

209. REPEATING PISTOLS; G. Tigneres, Covington, Louisiana.

Claim—The rack and dog, in combination with a sliding trigger, arranged and operated as set forth. Also, in combination with the plate, the arm, the bar, and the plate, arranged and actuated on as described.

210. GRIDIRON; John G. Treadwell, Albany, New York.

Claim—The employment of the gauze wire screen, or its equivalent, the gridiron, and the cover, when the same are used as specified.

211. ATTACHING SKATES TO BOOTS; Thomas Spur Whitman, City of New York.

Claim—Uniting the skate iron to the sole of the boot or shoe, in the manner stated.

212. ARTIFICIAL FUEL; H. Wilverth, Caseyville, Kentucky.

Claim—A composition formed by mixing the mentioned ingredients together, in the proportions and in the manner specified, for the purpose set forth.

213. SKATE FASTENINGS; Edward Wirths, City of New York.

Claim—The mode of attaching the side pieces to the skate, for the purpose of adapting the same to feet of different sizes, when the same shall be arranged and operated as set forth.

214. MACHINES FOR FEEDING-UP, CUTTING, AND PASTING DIRECTIONS ON NEWSPAPERS, &c.; Robert W. Wright, New Haven, Connecticut.

Claim—In combination with a strip or fillet of paper, on which the names or addresses are equi-distantly arranged, an intermittent feed motion, and a pasting, cutting, and carrying device, working automatically together, as described.

215. PIPE-CUTTER; James R. Brown, Boston, Assignor to self and J. Henry Norton, Medford, Massachusetts.

Claim—The pipe-cutting instrument, as constructed with the hinged and recessed jaws, the movable cutter, the adjusting screw, and the spring shank or shanks, extending from the jaws, and having a connexion hook, or its equivalent, as specified.

216. PRINTING PRESSES; Thomas H. Burridge, Assignor to self and Thomas W. Ustick, St. Louis, Missouri.

Claim—The direct application of steam power to the type table of a printing press, and in causing the same piston that actuates the said table to arrest the momentum thereof, as described.

217. COTTON-PACKERS; Lewis S. Chichester, Assignor to H. G. Evans, City of New York.

Claim—Pressing cotton and other fibrous substances into sacks, by placing the same on a hollow cylinder, fitted over an aperture of corresponding diameter in the flooring, and having clamps bearing or pressing against the sack on the cylinder, and so arranged as to allow the sack to render or give over the cylinder under the pressure of a plunger, while pressing the substance into the sack.

218. SHIFTING TOPS FOR WAGONS; Homer H. Dikeman, Assignor to Ira Dikeman & Son, New Haven, Conn.

Claim—The shifting slide or curtain rail, in combination with the jointed bows, constructed as described.

219. FERTILIZERS; W. D. Hall, Assignor to the Quinnissiac Company, Hamden, Connecticut.

Claim—Preparing concentrated artificial manure by boiling fish in common fresh water, until the whole

is thoroughly cooked, then removing it from the vessel, and when sufficiently drained, sprinkling on it from one to three per cent. (usually about two per cent.) by weight of sulphuric acid, mixing thoroughly, and drying by solar or artificial heat, when the whole is effected substantially in the manner and by the process described.

220. INDIA RUBBER BELTING; B. F. Lee, Assignor to the New York Rubber Co., City of New York.

Claim—The combination belting or banding specified, and consisting of two or more thicknesses or layers of fibrous material, cemented and quilted together, as set forth.

221. PIANO-FORTE ACTION; Frederick Mathushek, Assignor to self and Wellington Wells, City of New York.

Claim—The combination of the auxiliary jack, the regulating screws, the improved hammer butt, and improved arrangement of the spiral spring, with the French action, arranged as set forth.

222. MANUFACTURE OF INDIA RUBBER HOLLOW MOULDED ARTICLES; D. D. Parmelee, Salem, Assignor to J. A. Greene, Beverly, Massachusetts.

Claim—Making hollow articles of india rubber, or its equivalent, or their compounds, when the same are to be treated in the cold way, after moulding to effect the change, as described, by shaping the articles in moulds from bags formed of such rubber, and exhausting the air from between said moulds and the bags.

223. BOOT STRAP-FASTENER; Sylvanus Walker, Boston, Assignor to D. W. Smith, Somerville, Massachusetts.

Claim—The described boot strap-fastener, consisting of the plate or shield, and hollow rivets or eyelets, as described.

DECEMBER 27.

224. VISE AND SAW-SET; Norman Allen, Unionville, Connecticut.

Claim—The vise formed of the bars, A A, with jaws attached, the movable bar being actuated by the treadle, rod, C, and toggle, or their equivalents, in combination with the saw-set formed of the bar or bed, G, attached to the vise by the rod, F, and provided with the beveled plate, gauge, and adjustable centre, as set forth.

225. STRAW-CUTTERS; Wm. H. Baker, Daniel Dean, and B. L. Fetherolf, Tamaqua, Pennsylvania.

Claim—1st, The double-edged reciprocating knife, in connexion with the bed, arranged to operate as set forth. 2d, The arrangement of the eccentric, yoke, slide, lever frame, and bars, as described, for operating conjointly the feed bar and pressure bed. 3d, The eccentric plate placed on the shaft, when used in connexion with the slide to control its longitudinal movement, for the purpose set forth.

226. MACHINES FOR PULVERIZING QUARTZ; William Banham, San Francisco, California.

Claim—The circular troughs, constructed as described, in combination with the drags at the extremities of the radial arms, constructed in the manner set forth.

227. VENEERING MACHINES; R. D. Bartlett, Bangor, Maine.

Claim—The application of the throat gauge to the main and secondary cutters, so that both the gauge and secondary cutters can be turned upward away from the log, under circumstances and for the purpose or objects as set forth.

228. MAGNETO-ELECTRIC MACHINE; G. W. Beardslee, Flushing, New York.

Claim—The mode of operation of the pole-changer, by which the current is made to travel in the same direction, as described.

229. MAGNETO-ELECTRIC MACHINE; G. W. Beardslee, Flushing, New York.

Claim—The compound magnet described, consisting of radial poles, arranged about a common centre, and connected together at their inner ends, as described. Also, forming such a compound magnet, with radial poles connected at their inner ends, by cutting out the radial poles and connecting rings from a single plate, as specified. Also, in combination with rotating magnets, the insulated rings to which the terminal wires of the helices are connected, as described.

230. SEEDING MACHINES; James Bouton, Macon City, Missouri.

Claim—The arrangement of the wheels, pipes, covers, springs, and the yielding beam; also, the arrangement of the valve in the hopper, in the manner described.

231. MANUFACTURE OF HOES; Samuel Boyd, Brooklyn, New York.

Claim—The combination with the drop and anvil of the drop opening and mandrel, so that after the drop has given its blow, it will hold the hoe in place, and allow the mandrel to be passed through it into the hoe, to form and finish the eye thereof, as described.

232. GUIDES FOR SEWING MACHINES; O. G. Brady, City of New York.

Claim—The combination of the presser, having its sole formed with a curve, a grooved toe, and a recess, as described, and the curved guide tube, arranged relatively to the curved edge and toe of the presser, as described.

233. COTTON SEED PLANTERS; R. M. Brooks, Greenville, Georgia.

Claim—The arrangement of the wheels, the seed-box, the handles, the bar, the braces, I, coulter or opener, covers, arm, and brace, W, as described.

234. PLOUGHS; R. M. Brooks, Greenville, Georgia.

Claim—The arrangement of beam, screw foot, notch, plough hoe, opening, P, mould-boards, openings, U, nuts, and holes, constructed as described.

235. TOP PROPS FOR CARRIAGES; George Cook and H. I. Kimball, New Haven, Connecticut.

Claim—The combination of the thimble or pipe with the screw bolt or standard, and the joint bars, constructed as described.

236. REGISTER FOR RAILROAD CARS; S. F. Covington, Indianapolis, Indiana.

Claim—The indicator, when operated in connexion with the telegraph instrument, or its equivalent, using the Roman numerals, or their equivalents, and operating the same as set forth.

237. DITCHING MACHINES; Isaac R. Crane, Warsaw, Missouri.

Claim—The arrangement of the plough with the frame, and the scoop and elevator, and the described arrangement of devices for operating the said plough, in the manner described. Also, the arrangement of

devices whereby the scoop and elevator of my machine is lowered in and raised out of the ditch, in the manner described. Also, the arrangement of the guide wheel with the frame, and with the arrangement of devices for operating the said wheel, as described.

238. MACHINE FOR TURNING IRREGULAR FORMS; L. B. Miller, Newark, New Jersey, Assignor to A. D. Crane, Boston, Massachusetts, D. F. Tompkins, L. B. Miller, and C. T. Tompkins, Newark, and D. Holsman, Passaic, New Jersey.

Claim—1st, The double disc cutter head, constructed in the manner described. 2d, The consolidation of the separate cams into a solid former or consolidated cam, and the use of such consolidated cam or former, in combination with the said Crane's lathe. 3d, The use of the levers, formed and adjusted in the cutter's head, as described.

239. RAILROAD CAR COUPLINGS; J. G. Goshon, Assignor to self, H. Ruby, John Wunderlich, and H. R. Ruby, Shippensburg, Pennsylvania.

Claim—The longitudinal moving shaft, in combination with the spring, bolt, arm, and projection, as set forth.

240. LOCK; G. W. Dana, Durand, Illinois.

Claim—1st, The employment or use of a series of spindles, G K, provided with slots or recesses, and with lettered caps connected by catches, the spindles being arranged directly with the bolts, as with C, or indirectly, by means of wheel, F, as with B, either or both, for the purpose set forth. 2d, The slide bar, provided with the projections, arranged relatively with the slots and connected with the guard wheel, as shown, in connexion with the wheel, F, and spindles, G, arranged to operate as set forth.

241. CLOTH-HOLDER IN NEEDLE-WORK; Newell Daniels, Milford, Massachusetts.

Claim—A ladies' work-holder, to hold the work by the action of the piece towards and in connexion with the solid part of the frame, constructed and operating in the manner described.

242. SLEEPING CHAIRS FOR RAILROAD CARS; John Danner, Canton, Ohio.

Claim—1st, The limb-supporting device, in combination with the seats, constructed as described. 2d, The combination with the seats and frames of the backs, folding head rests, and slotted pieces, arranged and operating in relation to, and in combination with, the limb-supporting device, as set forth.

243. WASHING MACHINE; L. A. Dole, Salem, Ohio.

Claim—The arrangement consisting of the tub, rubber, hinged rubber, slotted arms, lever frame, and hinged inclined links, in the manner described.

244. CLARIFYING CANE JUICE; Francisco Domenech, Ponce, Island of Puerto Rico; patented in the Island of Puerto Rico, August 17, 1858.

Claim—The method of determining the amount of lime necessary to be added to the raw juice, to defecate the same, by the employment of the volumetric method, as set forth.

245. APPARATUSES FOR EVAPORATING SUGAR JUICES; Eugene Duchamp, St. Martinsville, Louisiana.

Claim—1st, The arrangement of a vertical boiler in front of the furnace, having a funnel, spiral conveyor, and cone, when the whole are combined for the purpose and in the manner set forth. 2d, In combination with the above vertical boiler, the semi-cylindrical concentrating boiler, when the same is constructed and arranged in the manner specified.

246. BED BOTTOM; A. M. Dye, Clinton, Illinois.

Claim—The attaching of the traverse bars of the frame to the side strips, by means of the dovetail slides, and sockets or guides, provided with the screws, and attaching the bars of the frame to the side strips, by means of the set-screws, as specified.

247. AMALGAMATOR; Lucius Eddleblute, Garden Valley, California.

Claim—The combination of the bars with the inclined or bevel slats, and inclined top and bottom, as shown, so that the water has an easy access, and in its fall first strikes the edges of the bars, and thus avoids the washing of the quicksilver, as set forth.

248. BEDSTEAD; Seraphin Espach, Cincinnati, Ohio.

Claim—The described arrangement and combination of parts consisting essentially of the foundation, and its springs, posts, rails, hooks, and their sockets, the braces, and their adjusting screw, and the lattice work-head and foot-boards.

249. EXTENSION SEATS FOR CARRIAGES; Francis J. Flowers, Rahway, New Jersey.

Claim—1st, The operation and combination of the raising bar, or its equivalent, with the parts A and C. 2d, The combination of the recess with the legs. 2d, Forming the joints, in combination with the boot, for the purpose set forth.

250. CARVING FORK; Henry Garbanati, Brooklyn, New York.

Claim—The permanent spur guard and the fulcrum guard, in combination with a carving fork, as described.

251. MANUFACTURE OF INDIA RUBBER BELTING; Dennis C. Gately, Newtown, Connecticut.

Claim—The improvement in the manufacture of machine belting or banding, composed wholly or in part of india rubber or gutta percha, the same consisting in rolling or winding up the belt or band with any suitable non-adhesive substance or composition interposed between its folds or layers, and then heating it in the manner and for the purposes described.

252. CULTIVATORS; Henry Gilliard, Mount Hope, Wisconsin.

Claim—The arrangement of the permanent circles and jointed bars, constructed for joint operation, as set forth.

253. HARVESTERS; John Gore, Brattleboro', Vermont.

Claim—The use of lever, constructed as described, in combination with the tapering draw bar for elevating the cutting apparatus of the harvester, in the manner described.

254. SELF-ADJUSTING COUNTER BRACES OF TRUSS BRIDGES; John Gray, Nashville, Tennessee.

Claim—The application, to counter braces in truss bridges, of a socket at the top, a heel and key at the bottom, by which the counter braces in truss bridges are made self-tightening and adjusting, as described.

255. MACHINE FOR PLANING CURVED SURFACES; J. P. Grosvenor, Lowell, Massachusetts.

Claim—The employment or use of the adjustable or yielding feed rollers, when combined with a bearing

roller or a proper bearing surface, and arranged relatively with each other, as described, to admit of the feeding of circular, oval, and serpentine forms to the cutters. Also, placing the rollers in an adjustable frame or box, G, fitted in an adjustable box, E, and used in connexion with the elastic bars, or their equivalent, and the bearing rollers, whereby the frame or pattern may be properly adjusted and retained in proper position between the rollers while being acted upon by the cutters.

256. CIRCULAR FORMS; Joseph A. Grunwald, City of New York; patented in France, September 20, 1859.

Claim—1st, The manner of weaving in a horizontal circular plane by means of two or more wefts, and an arrangement of warps placed alternately above and below the weft threads, arranged in the manner described. 2d, The arrangement of the weft bobbin carriage, in combination with the arrangement of regulating the tension on the weft thread, as described. 3d, The arrangement and construction of the tension levers, for the purpose of maintaining the tension of the warp threads as well as the friction against the warp bobbins, acting together in the manner set forth. 4th, The arrangement of the serrated pulley, in combination with the rollers, operating together in the manner described, and for the purpose of delivering the manufactured article as fast as finished and at a regular tension. 5th, The arrangement of the disengaging gear, constructed as described, and for the purpose of throwing the loom out of gear as soon as one of the weft threads break, the same being operated by a lever attached to the weft bobbin carriage, and acted upon by the weft thread, in the manner set forth.

257. SEWING MACHINES; James Harrison, Jr., City of New York.

Claim—1st, The rotary needle guide disc, constructed and operated in the manner described. 2d, The arrangement of the following devices for holding and operating the shuttle, viz: the arm, the revolving button, slotted to receive the arm, the shuttle case, rod, and its head, spring, and legs, all constructed as described. 3d, Constructing the shuttle with the ridge, and holes, and thread space, as described. 4th, Inserting the lever bar in the needle bar, and operating it as described.

258. GANG PLOUGHS; T. S. Heptinstall, Mendota, Illinois.

Claim—The arrangement of the wheels, shafts, spindle, triangle, rod, lever pole, regulator, and rollers, as described.

259. PROCESS FOR MAKING SULPHURIC ACID; Homer Holland, Westfield, Massachusetts.

Claim—The generation of sulphuric acid by treating sulphides and nitrates commingled in close vessels, in connexion with the ordinary sulphuric acid chamber, and for the purpose as set forth.

260. PROCESS FOR THE PRODUCTION OF SULPHATE AND OXIDES OF COPPER; Homer Holland, Westfield, Mass.

Claim—The production of sulphate of copper, together with the oxides of copper, from its various sulphurets, by the use of the nitrate of soda, according to the process already described.

261. MODE OF TREATING METALLIFEROUS SULPHURETS; Homer Holland, Westfield, Massachusetts.

Claim—The treatment of metalliferous sulphides with the native nitrate of lime, or nitrate of lime and magnesia, in iron vessels, in the manner set forth.

262. BEE-HIVES; Jesse Jacobs, Yellow Springs, Ohio.

Claim—The "valve," composed essentially of the vestibule, an adjustable counter-weighted valve pedal, arranged in the manner specified.

263. STRAW-CUTTERS; Aaron E. James, Decatur, Illinois.

Claim—Feeding the straw towards the knife, by means of two feed rolls between which the straw passes, when said rolls or cylinders are both operated simultaneously by the positive action of separate pawls, or their equivalents, working in ratchets made and arranged in said rolls, in the manner described.

264. WATCHES; Henry Boehm James, Trenton, New Jersey.

Claim—Controlling the active length of the pendulous or hair spring of a watch, or other time-keeper governed by a balance, by means of combined laminæ of different metals, so applied to act upon the end of the spring which has been commonly fixed that, by an increase or diminution of temperature, the said spring is caused to be taken up or let out through the curb pins, or their equivalents, and so to compensate for the expansion and contraction of the said spring and the balance, as described.

265. PREPARATION OF TOBACCO; George Jaques, Somerville, Massachusetts.

Claim—The described preparation of tobacco, consisting of the soluble and volatile portions, as set forth.

266. APPARATUS FOR HEATING WATER; James M. Jay and John Darmer, Canton, Ohio.

Claim—The combination and relative arrangement of the parts composing the water-heater, as set forth.

267. COTTON SEED PLANTERS; Charles Kesler and Fred. Reinhard, Columbus, Texas.

Claim—The arrangement in a hopper of the roller, with stirring teeth and feeding teeth, in combination with the perforated partition and the distributing roller, as specified.

268. COTTON CULTIVATORS; John R. King, Raleigh, Tennessee.

Claim—The arrangement of the frame and wing or mould-board, cast solid together, extra landside with its tenons and brace, with the cotton scraper, as described.

269. FOLDING BEDSTEAD; John B. Koch, City of New York.

Claim—The combined arrangement of the shoulder and eccentric, both situated below the rails and inside the bedstead, to secure the side rails in their proper place when the bedstead is unfolded, and at the same time to relieve the pins of the strain, in the manner specified.

270. HORSE HAY RAKES; Samuel Lessig, Reading, Pennsylvania.

Claim—The swingletree, sliding bar, 3, spring, braces, 6, axle, bar, g, sleeves, beam, braces, j, slotted teeth guides, rollers, arms, and connecting bars, 11, constructed and arranged as set forth.

271. ROOFING COMPOSITION; S. M. Logan, Richmond, Indiana.

Claim—The described composition, constructed and used substantially as specified.

272. EXCAVATING MACHINE; Thomas R. Markillie, Winchester, Illinois.

Claim—1st, The combination of the carrying wheel, as constructed and operated, with the reversible plough, so arranged for the purposes set forth. 2d, In combination with the carrying wheel and plough, I claim the elevator, as arranged and operated for the purposes described. 3d, The hinged wheel frame, arranged and combined with the lever and rock bar, for the purposes set forth.

273. MANUFACTURE OF GUNPOWDER; V. L. Maxwell, Wilkesbarre, Massachusetts.

Claim—The employment of alcohol in lieu of water as the vehicle to unite the particles of the ingredients of which the powder is to be composed, as described.

274. APPARATUS FOR FORMING RUBBER BELTING; Thomas J. Mayall, Roxbury, Massachusetts.

Claim—1st, The use of the two rollers, u and v, acting together so as to form the bolt into a gutter shape, whereby the first step in the process of folding the outside sheet or covering of rubber or gutta percha over the body or inner fabric of the belt is effected. 2d, The roller, x, having two tapering surfaces and a central disc, whereby the overlapping of the covering or outer sheet over the inner fabric is completed, and the edges of the outer sheet or covering brought to a true and even line before being united. 3d, Bringing the two edges of the outer sheet or covering evenly together, so as to form a true and perfect joint, and complete the formation of the belt or band by the employment of two or more rollers, arranged in relation to each other, so that the said belt or band shall be drawn partially around the periphery of either or all the said rollers, in the manner set forth. 4th, In combination with the machinery for forming the belt or band, I claim the device for cutting both the outer and inner sheets into straps of any desired width, as described.

275. COTTON GINS; William McLendon, Greenville, Georgia.

Claim—Beveling the edges of the roll box from the saws, as set forth.

276. SEED PLANTERS; James T. Mercer, Seneca Township, Ohio.

Claim—The arrangement of the handles, beam, pivot, stirrup, wheel, arms, lever, slide, hopper, spring, markers, and coverers, constructed as described.

277. COTTON CULTIVATORS; Peter Monaghan, Camak, Georgia.

Claim—In combination with the hinged frame of a cotton cultivator, the spring, which is secured to the tongue of said cultivator, for the purpose of automatically raising the rear end of the machine, when the same is released by the operator, in the manner described.

278. ROLLING CORRUGATED METALS; Richard Montgomery, City of New York.

Claim—The combination and relative arrangement of the corrugating rolls with the holding and smoothing rolls, forming roll, H, and carriage, operating in relation to each other as set forth.

279. RAILROAD CAR COUPLING; Conrad Norpel, Newark, Ohio.

Claim—The arrangement, 1st, of the jaw, A, with the beam, B, and pin, D, for the purpose aforesaid. 2d, Of the jaw, K, with the pin, L, combined with the coupling bar and fish-tailed end, for the purpose described. 3d, Of the two wings combined with the slide, for the purpose described.

280. MODE OF OPERATING SAW-MILL BLOCKS; A. B. Norris, St. Louis, Missouri.

Claim—The use of a lever with a vibrating fulcrum, in combination with the dog or reciprocating carriage, as the means of communicating motion to the slides or knees of saw-mill head blocks, as described. Also, the combination of the cam lever with the knee, and the means of operating the same for the purpose of securing the said knee, as described.

281. SEEDING MACHINES; Worden P. Penn, Belleville, Illinois.

Claim—Arranging the grass seed hopper in front of the grain hopper, with the reflector fixed against its under side, in relation to the grass seed-box and the grain box, and the pipe and leader, as described.

282. SEED DRILLS; Worden P. Penn, Belleville, Illinois.

Claim—The arrangement of the endless chain with the eccentric bar and valve bar, with the valves thereto attached, for the purpose of closing and opening the said valves and raising the flukes simultaneously in the manner described.

283. AUGER; Napoleon B. Phelps, Rochester, New York.

Claim—Uniting and combining the terminating coil with the preceding one by means of the thin supporting wall, acting as a brace to sustain and strengthen the cutting portion of the bit or auger, in the manner described.

284. MANUFACTURE OF POROUS WARE; Bradford S. Pierce, New Bedford, and Mason R. Pierce, Mansfield, Mass.

Claim—The manufacture of porous drain pipes, and other vessels which require to possess the property of porosity, when formed from the ingredients set forth, and made to cohere by the process of tampering, or other equivalent mode of pressure, as described, and receiving its porosity from the small proportion of water used in mixing the ingredients, as described.

285. SEEDING MACHINES; James W. Prentiss, Pultney, New York.

Claim—The divided revolving cylinder and slides, arranged as set forth, in combination with the peculiarly-formed spring teeth with their cups, made and used as specified.

286. HARVESTERS; Samuel N. Purse, Ashley, Missouri.

Claim—The arrangement and combination of the shafts with the driving wheel and cutter and the pinions, as shown, for the purpose of changing the velocity of the knives, in the manner described.

287. STAIR CARPET-FASTENER; Clinton Rice, City of New York.

Claim—The general combination and application of the main piece with the hook and eye, and the spring bolt and catching apparatus, as described.

288. CULTIVATORS; Morgan L. Rogers, Spring, Pennsylvania.

Claim—The arrangement of the hooked and double curved central box, curved slotted arm, wheel, handles, sliding plates, frame pieces, and cross-piece, as described.

289. STEAM ENGINES FOR LAND CARRIAGES; Robert E. Rogers, Philadelphia, Pennsylvania.

Claim—Connecting the safety valve, the gauge or try-cocks, and all the steam escape orifices of an engine and boiler, with a condensing apparatus, whereby the steam which may escape or be let off, either occasionally or continually, may be prevented from producing its peculiar harsh noise, as described.

290. PLOUGHS; George W. Roney, Assignor to self and Walter F. Lloyd, Bailey's Mills, Florida.

Claim—In combination with a beam, standard, handles, and shoe, rigidly connected together, the hinging of the coulter to the shoe at a, by its lower end, and the adjusting devices in the beam at its upper end, as stated and for the purpose set forth.

291. SURVEYING INSTRUMENT; Riley Root, Galesburg, Illinois.

Claim—The arrangement of a revolving double spirit level adapted to a graduated circle, as set forth, for astronomical and engineering purposes.

292. RETAINERS FOR HYDRAULIC PURPOSES; Christopher E. Rymes, Charlestown, Massachusetts.

Claim—The arrangement and application of the two wedges and their operative screw shaft (provided with screws, as described,) in the follower, and with respect to, and so as to operate with, slots formed and arranged in the bars, as specified. And, in combination with the slots and the wedges, and their operative mechanism applied to the follower, as described, I claim the elevating racks and pinions, arranged in, and applied to, the follower and its upright bars, essentially in the manner as set forth.

293. HERNIAL TRUSSES; Richard S. Schevenell, Athens, Georgia.

Claim—Combining one or more spring pads and one or more thigh straps with the belt, by means of one or more clamps, screws, and nuts, applied as specified.

294. RAILROAD CHAIRS; Leander Shearer, Duncannon, Pennsylvania.

Claim—In combination with the chair formed with a lip and ears, the sliding securing block, and lugs, and cavities, in the ends of the rails, constructed and arranged as specified.

295. ELECTRIC TELEGRAPHING APPARATUS; Francis O. J. Smith, Westbrook, Maine.

Claim—The mode of combination of apparatus, instruments, and machines, used conjointly in the manner and for the purposes described, and dispensing therein with all artificial insulations of conducting circuits for telegraphic purposes.

296. BRAKES FOR HORSE CARS; John Stephenson, City of New York.

Claim—Arranging the brakes of a reversible car or other vehicle, as described, so that the same can be applied from the driver's seat with equal facility, in whatever direction the car or vehicle may be turned.

297. LATHE ATTACHMENT FOR CUTTING VENEERS; B. F. Sturtevant, Boston, Massachusetts.

Claim—Compressing the wood in the immediate vicinity of the edge of the knife, by means of the presser bar, or its equivalent, arranged as set forth. Also, the cutters, or their equivalents, for the purpose specified.

298. APPARATUSES FOR RELIEVING SPINAL CURVATURE; Charles F. Taylor, City of New York.

Claim—1st, A spinal supporter or assistant, in which two longitudinal dorsal plates or supports are jointed together in sections, in the manner described. 2d, Arranging the dorsal plates in the manner described, by which the pressure which is exerted in a forward direction is thrown upon the angles of the ribs, instead of upon the vertel braces or vertebral columns, as formerly.

299. BRUSH FOR FINGER NAILS; William Thompson, Buffalo, New York.

Claim—The combination of a stationary or movable cylinder with a circular brush, as described.

300. SEED CULTIVATORS; Samuel D. Tracy, Vernon, New York.

Claim—Giving the zigzag or alternate opposite inclinations to the blades of the spur wheels, in the manner set forth. Also, the combination of the movable or adjustable cutters and their slotted supports with the zigzag spur wheels, in the manner specified. Also, the arrangement of the seed box in grooves in the underside of the hinged seat, so as to be adjustable beneath it, removable therefrom, or turned up therewith, as described. Also, the vibrating seed-distributor, constructed as specified.

301. STOVES; John G. Treadwell, Albany, New York.

Claim—Arranging the dampers, a and c, with the ventilating flue, and with the draft flue, in such a manner that the ventilating flue may be opened or closed while the draft flue is either open or closed, or vice-versa, the damper, a, being made to subserve a double purpose.

302. MACHINES FOR PREPARING PLUG CHEWING TOBACCO; Walter J. Van Horn and Wm. Alexander, Louisiana, Missouri.

Claim—A machine for preparing and cutting tobacco, consisting of a central cylinder, endless belts, belt rollers, pressing rollers, receiving table, and cutting rollers, arranged and operating as described, so that the leaf tobacco, on being fed from the table, will be pressed, cut, and delivered in the form of plugs, as set forth.

303. PLOUGHS; Samuel Walker, Kingston, Georgia.

Claim—The arrangement of the beam, bars, foot, and handles, as described, in order to permit of the adjustment of the parts, as set forth.

304. RAILROAD CHAIRS; J. W. Wetmore, Erie, Pennsylvania.

Claim—The use of a yoke band passing through notches in the hands and webs of the "T" or "H" rails at the joint, and keyed by a wedge under the plate, arranged as described.

305. COTTON PRESSES; Paul Williams, Lodi, Mississippi.

Claim—The combination of the levers, H H and J J, with the levers, I I and K K, links, and projections, arranged as set forth.

306. SPINDLES AND FLYERS; Cyriel E. Brown, Assignor to self, John Tenny, and John Rhodes, Millbury, Mass.

Claim—The arrangement of the secondary or tubular stationary bearing with the flyer and spindle, as described. Also, the combination of a helical eye with the flyer arm and its hook, and to open in the hook. Also, making the top of the bearing and that of the flyer neck with an oil channel, so arranged as not only to receive or catch the oil that runs off the spindle, but direct or conduct it between the rubbing surfaces of the said neck and bearing. I do not claim an oil cap as ordinarily applied to the foot of a spindle, nor as applied to a cop tube and spindle, as shown in the United States Patent, No. 16,298; but I claim combining or arranging an oil receiver and bearing with the secondary bearing tube, and so as to surround it, the spindle and flyer neck, in the manner specified.

307. STRAW-CUTTERS; Franklin B. Hunt, Assignor to R. D. Van Deursen and J. B. Gibbs, Cincinnati, Ohio.

Claim—The described feeding device, consisting essentially of the rolls, link bearings, rest blocks, and springs, arranged with reference to each other, and so as to operate conjointly as set forth.

308. SEWING MACHINES; James Rowe, Assignor to self and Martin B. Ewing, Cincinnati, Ohio.

Claim—The bar or bracket, b, on the lower end of the needle bar, so that it shall, in combination with the looper bar, k k', and the feeding levers, by positive movement, when it is driven by the crank pin, all operating in the manner set forth.

309. PORTABLE REGISTER; Charles H. Watson, Assignor to self, A. L. Ashmead, and E. W. Carr, Philadelphia, Pennsylvania.

Claim—1st, A portable alarm register, constructed and operating as described. 2d, The dogs on the annular plates, in combination with the pins on the inner front plate, as described. 3d, The combination of the

dogs with the notches or pins of the annular plates, and the openings in the rims through which the dogs operate, as described.

310. PEACH-PARER; Mary E. Hemans, Administratrix of the estate of Alva Hemans, deceased, Henderson, Texas.

Claim—The combination of the rotating and elastic or yielding tines or prongs, knife stock, and plate or bed, arranged as set forth.

311. REVOLVING FIRE ARMS; Joseph Gruler and Augustus Rebety, Norwich, Connecticut, Assignor to the Manhattan Fire Arms Company.

Claim—The use of the intermediate recesses, in combination with the stop, actuated by the hammer in pistols where the cylinder is revolved in the act of cocking the pistol, as described, thereby effecting a self-acting lock of the cylinder, midway or otherwise between any two cones.

EXTENSIONS.

1. CORN SHELLERS; Thomas D. Burrall, Geneva, New York; patented December 6, 1845; extended December 6, 1859.

Claim—Making the concave plate or disc with a concave face and circular opening provided with a lower and upper lip for the discharge of the cobs, in combination with the sheller and with the sheller bottom, and also with the door or valve in the side for broken cobs, &c., and also the cylindrical hopper and spring, in combination with the feeder, as described.

2. DREDGING MACHINES; James Hamilton, City of New York; patented March 30, 1852; ante-dated Dec. 16, 1845; extended December 6, 1859.

Claim—The shovels or scoops forming the bottom of the compartment in a proper frame, and moving at one end on a hinge or similar contrivance, the other end being lowered to cause the scoop, as the frame is moved along, to collect the sand or mud or other material operated on, and retain the same by suitable mechanical means operating to lift the scoop and close the bottom, as described.

3. COOKING STOVES; Samuel Pierce, Troy, New York; patented Dec. 6, 1845; re-issued April 24, 1847; re-re-issued July 31, 1847; extended December 13, 1859.

Claim—Making the top of the metal ovens of cooking stoves of fine brick, or other earthy substance, when this is combined with a stove in which the products of combustion from the fire chamber pass first over the top of the oven, as described, whereby the heat in the oven is equalized, and the vapors or gases evolved in the oven are absorbed and carried off, as described. Also, the arrangement of parts by which I supply the fire with heated air, said arrangement consisting mainly of the apertures in the front plate or doors and the plate, s, in front of which the air must descend on its passage to the grate bars: the heating of the admitted air has been attempted under other arrangements, and I limit myself in this particular, therefore, to the special combination of parts by which I attain this end. And finally, making the plate of that part of the oven which extends under the grate, in the manner as described, and connected with a receptacle for ashes at the bottom for the purpose of discharging the ashes that fall from the grate, whereby I am enabled to heat this part of the oven more effectually and equally, and to avoid the burning out of the grates.

4. MACHINERY FOR DRESSING COMBS; Calvin B. Rogers, Saybrook, Connecticut; patented Dec. 20, 1845; extended December 20, 1859.

Claim—The manner in which I have arranged the apparatus for carrying the plates between the cylinders, consisting of the box, the slide with its piece, and the wheel connected by the rod to the slide and to the shaft by the small wheel, and the gripe, heretofore described, operating as before stated. Also, the manner in which I have arranged the top bed, whereby plates varying in thickness are equally scraped, not reducing the thickness of one more than another, said arrangement consisting of the spring, and the position of said bed with its space. Also, the manner in which I have arranged the chisels for scraping, smoothing, and shaping the plate, said arrangement consisting of the levers, the cross-pieces, and the apparatus for securing the chisels to the cross-pieces, and for securing the cross-pieces to the levers, and for the movement up or down for the same by the screws. Also, the manner in which I have arranged the box to receive the plates from the top bed, consisting of the spring on the underside of the lid, and the bed with its tapering rod clasped by the springs under the said box, operating as before stated. And I hereby declare that I do not intend by these claims to limit myself to the exact form or arrangement of the respective parts and combinations, as described and represented, but to vary these as I may deem expedient, while such arrangement and combinations are substantially the same with those made known.

5. STEAM BOILERS; James Montgomery, City of New York; patented December 26, 1845; extended December 27, 1859.

Claim—The employment of vertical, or nearly vertical, water tubes for steam boilers or generators that open into water chambers at top and bottom, which water chambers are connected together by a surrounding jacket or water space made singly or in sections, to admit of the free circulation of the water which, rising in the tubes by the effect of the heat, will descend in the surrounding jacket or external water space or spaces, and thus by this circulation carry off the heat from the tubes and prevent them from overheating, when this is combined with the fire chamber placed at the side of the boiler and outside of the series of tubes, whereby the tubes are prevented from being overheated and unequally expanded to an injurious extent, and the water kept cooler in the jacket than in the series of tubes. Also, in combination with vertical, or nearly vertical, tubes and surrounding water space or spaces, the employment of a fire chamber outside of the series of tubes, and so arranged and located as to apply the most intense heat at their upper ends and the reduced heat towards their lower ends, whereby a greater circulation and evaporation are obtained, with a given amount of fuel, than by any plan known to me, thereby not only economizing fuel, but effectually preventing the incrustation of the tubes by the deposit of mineral and other solid matters. Also, the employment of a diaphragm or partition in the flue space between the series of tubes surrounded by the water space or spaces, and in combination therewith to divide the same into two parts, that the products of combustion after passing around the upper end of the tubes may pass around their lower ends, and thus more effectually expose the upper end of the tubes to a more intense heat than their lower. Also, the making of the bottom of the boiler of a conical or dished form, with a mud or blow-off valve in the lowest part of the concavity, in combination with the vertical tubes communicating with the bottom, in the manner described, to permit the deposit of the sediment—there being a water space surrounding them to induce circulation of the water up the tubes towards the mud or blow-off valve.

ADDITIONAL IMPROVEMENTS.

1. CLOTHES PINS; Ephraim Parker, Marlow, New Hampshire; patented January 15, 1856; additional dated December 13, 1859.

Claim—Adding bits to the machine so as to bore the stuff at the time it is being shaped and turned at the same operation. Also, as above, the boring the stuff first and then putting it upon a small mandrel which revolves, so that the work shall be turned and shaped to the right pattern, and finished at each end upon its own centre hole, all at one operation. Also, the above improvements, as before set forth, or any equivalent, which substantially effects either of the above objects, by any other arrangements of mechanism or mechanical devices.

2. REFRIGERATORS; William Sims, Dayton, Ohio; patented February 8, 1859; additional dated Dec. 13, 1859.

Claim—The arrangement, severally, of the escape pipe, in combination with the induction pipe, so as to operate conjointly therewith and in connexion with a flue, as set forth.

RE-ISSUES.

1. COATING METALLIC SURFACES; William and William A. Butcher, Philadelphia, Pennsylvania; patented June 29, 1858; re-issued December 6, 1859.

Claim—The combined process, substantially as described, of coating metals with the composition made of india rubber or allied gum, dissolved in, and combined with linseed oil, in a heated state, in proportions substantially such as set forth, by first heating the metal to be coated to about 350°, applying the composition to the metallic surface while so heated, and then subjecting the metal so coated to about 260° of heat.

2. PLOUGHS; Isaac Rulofson, Assignor to self and Lemuel Harvey, Penn Yan, New York; patented March 1, 1859; re-issued December 13, 1859.

Claim—Moving and adjusting the beam laterally upon the standard, by means of the head and dovetailed connexions, in such a manner that the line of draft or direction of the beam shall always remain parallel with the land-side of the implement, as described.

3. BOILERS AND STEAMERS; Daniel R. Prindle, Bethany, New York; patented September 13, 1859; re-issued December 13, 1859.

Claim—The construction and arrangement of the two sections, A and B, so that the section, A, may be used separately as a caldron, or both sections be securely united and employed as an enclosed boiler for generating steam. Also, the combination of the cylindrical or cylandroidal support and fire-box entirely open at the top, with the uniting and supporting flanches of the spherical or spheroidal sections, A B, constructed so that, by presenting a thin edge only to the flanches, it allows the utmost facility of clamping and unclamping the sections, and of moving or adjusting the same, while it firmly sustains the boiler, and shields the packing between the flanches from the heat of the fires. Also, the trough, formed by the tip projecting above the upper flanch, for the purpose of containing water to protect the packing between the flanches from injury by heat.

4. PUMPS; John M. Lunquest, Griffin, Georgia; patented November 1, 1859; re-issued Dec. 13, 1859.

Claim—The arrangement of two or more cylinders, piston heads, ball valves, a a, air chamber, and valves, a' a', said valves being kept in position by proximity to each other and the sides of the chamber, in the manner specified.

5. HARVESTERS; M'Clintock Young, Jr., Frederick, Maryland; patented Sept. 21, 1858; re-issued July 19, 1859; re-re-issued December 13, 1859.

Claim—Giving the rake the two described regularly succeeding axial movements over and across the platform of said machine, that is to say, an elevated curvilinear movement from rear to front over said platform, and a horizontal movement from front to rear upon or near to said platform, by the means described.

6. PANS FOR EVAPORATING CANE JUICE; D. M. Cook, Mansfield, Ohio; patented June 22, 1858; re-issued December 20, 1859.

Claim—1st, The combination with a fire furnace of a sugar evaporating pan, when said pan is constructed and arranged so as to allow of a continuous circulation of the syrup in an indirect course over its surface, during the process of boiling. 2d, So arranging the pan on the surface, that a portion of its bottom surface near each side shall not be exposed to the direct heat of the furnace, and thus while the intermediate surface of the bottom of the pan is intensely heated, the other portions remain comparatively cool. 3d, Retarding the escape of the syrup, or facilitating its escape, either by giving the pan a vibrating motion, or a greater or less inclination. 4th, An evaporating apparatus which allows of a circulation of the steam of syrup, boils it at the centre of the pan and cools it at the sides of the same, and affords facilities for regulating the flow of the steam, as set forth.

7. STOP-COCKS; Erastus Stebbins, Chicopee, Massachusetts; patented April 19, 1859; re-issued December 20, 1859.

Claim—1st, The arrangement and combination of the collar, flexible washer, and washer, as described. 2d, The chambered square nut or valve, when its seat is formed in the body of the cock, in the manner described.

8. MACHINE FOR SPLITTING FIRE-WOOD; Wm. L. Williams, City of New York; patented April 19, 1859; re-issued December 20, 1859.

Claim—1st, Feeding the wood to be split by the endless chain, so arranged that the chain can receive a lateral movement, for the purposes specified. 2d, In combination with the endless chain to feed the wood, as aforesaid, I claim the rollers for permitting a lateral movement and taking up any slack. 3d, The yielding pawls, in combination with the feeding chains, for permitting backward movement to the wood as the knife enters the same, thereby preventing the wedging of the wood or injury to the parts. 4th, The spurs, to give lateral motion to the chain, in combination with the arms and yielding connexion to the rods, as described. 5th, The yielding end pieces to regulate the delivery and sustain the wood while being split, and prevent the same falling over before being separated by the second cut.

9. SKELETON SKIRTS; James Draper, Hudson City, New Jersey, Assignor to self and S. H. Doughty, Assignors to selves, James Brown, and William King, City of New York; patented October 4, 1859; re-issued December 27, 1859.

Claim—The manufacture of skeleton skirts, in which the hoops are fastened between separately woven

parts of the tapes, as described, when the parts are woven together as single tapes between the hoops, and separately as distinct tapes at the points where the hoops are received.

10. TABLE CASTER; R. Gleason & Sons, Assignees of R. Gleason, Jr., Dorchester, Mass.; patented March 8, 1859; re-issued December 27, 1859.

Claim—1st, The combination of the caster and egg-stand. 2d, The combination of the caster and bell. 3d, The combination of the caster, egg-stand, and table bell, as described.

11. EVAPORATING APPARATUS; James McCracken, Bloomfield, New Jersey; patented March 13, 1855; re-issued December 27, 1859.

Claim—A pan for containing solutions to be heated, in combination with a vessel contained therein, the top and bottom of which are connected by a series of vertical, or nearly vertical tubes, the interior of such vessels being connected with proper pipes for the supply of steam and the escape of steam or condensed vapor, constructed in the manner set forth.

12. COOKING STOVES; Giles F. Filley, St. Louis, Missouri; patented June 14, 1853; re-issued Dec. 27, 1859.

Claim—1st, The flaring enlargement of the side flues, C C and D D, from the space above the oven to the flue space, E, which extends under the entire front end of the oven—and also the flaring enlargement of the central flues of F and of G, from the flue space, E, to the upper end, G, for the purpose of increasing the draft of the stove, as set forth. 2d, Separating the front of the oven from the front plate of the stove, and also from the hearth plate, and from the back plate of the fire chamber, by means of the flue space, H, which communicates freely with the flue space, E, and is closed at all other points—the said arrangement enabling the flue space, H, to arrest the great amount of heat that will be radiated from the back plate of the fire chamber, and conduct the same (by means of the circulation which it will create in said flue space,) into the flue space, E, for the purpose of producing the beneficial results herein particularly set forth.

DESIGNS.

1. TRADE-MARK; O. T. Bragg and M. Burrows, St. Louis, Missouri; dated December 20, 1859.

2. TRADE-MARK FOR SOAP-BOXES; Thomas and Samuel Lincoln, Providence, Rhode Island; dated December 20, 1859.

3. FLOOR OILCLOTHS, CARPETS, &c.; Jeremiah Meyer, City of New York, Assignor to Alden Sampson, Manchester, Maine; dated December 20, 1859.

4. CARPETS, &c. (2 cases); E. J. Ney, Assignor to the Lowell Manufacturing Company, Lowell, Massachusetts; dated December 20, 1859.

5. PARLOR STOVES; Garrettson Smith and Henry Brown, Assignors to J. G. Abbott, Philadelphia, Penna.; dated December 20, 1859.

6. CARPET PATTERNS (5 cases); H. G. Thompson, City of New York, Assignor to the Hartford Carpet Company, Hartford, Connecticut; dated December 20, 1859.

MECHANICS, PHYSICS, AND CHEMISTRY.

*Purification of Paraffine or Solid Portable Illuminating Gas.**

Since the discovery, by Reichenbach, of the existence of the curious hydro-carbon "paraffine" in tar, much chemical attention has been directed towards the effective utilization of its peculiarly valuable properties. Up to the present time little has been done with it, and the crude material, as produced in the distillatory processes for the product of oils and fats, accumulates in many cases as a useless incumbrance in the works of manufacturing chemists. Originally detected in the tar of beech wood, it is now made in large quantities from peat, and more recently still, from that wonderful debateable mineral, "boghead coal," peculiar to a certain district of Scotland. It is a white, crystalline, solid, volatile substance, bearing a strong resemblance to wax, but is quite tasteless, colorless, and inodorous, is fusible at about 110°, and resists the action of the powerful caustic acids, whilst alkalies and chlorine fail to exert the smallest action on it. Its peculiar name is derived from the words *parum* little, and *affinis* akin, to denote its remarkable chemical indifference or want of affinity.

The great difficulty in the way of bringing paraffine within the working commercial pale, has been that of purification, and decoloration.

*From the Lond. Practical Mechanics' Magazine, Sept., 1859.

Now, however, we are coming to important practical results in this way, and we have before us some beautiful samples of hard, brilliant, white, and sweet paraffine. It resembles spermaceti in its silky feeling and physical structure, but at the same time presents a waxy appearance, gives a powerful clear flame without soot, melts into a colorless oil, and it may be properly considered as a solid portable illuminating gas. It holds a successful competition with wax and sperm, on account of the great uniformity of its combustion, high illuminating power, and beautiful appearance, melting at a temperature of 29° above that previously made. This is the patented product of a process lately invented by Dr. C. M. Kernot, of Gloucester House, West Cowes, Isle of Wight. In his process Dr. Kernot boils the crude paraffine in water or steam, so as to free it as much as possible from its oil, and render it inodorous and hard. He discards acids altogether, and taking advantage of the fact, that the tar with which the crude paraffine is mixed, melts at a higher temperature than the paraffine itself, he heats the raw material to the temperature just sufficient to disengage the two constituents, and he then filters it, when the pure paraffine passes through the filtering medium, and the tar, with any other impurities, is left on the filter.

The melting is performed in a pan heated with steam tubes, and fitted with a movable perforated bottom, on which is placed a layer of felt as a filter. As paraffine melts at about 110° or 112°, the heat is raised to 130°, taking care not to reach 180°, the melting heat of tar.

When it is necessary to decolorize any oil which may be left in the paraffine, and cannot be taken out by hydrostatic pressure, or by centrifugal apparatus, the inventor uses chloro-chromic acid, or chloro-chromic acid gas, agitating the acid and paraffine together, in a "compound opposite rotator," at a temperature of from 110° to 200°. After this, the mass is washed with warm water to get rid of the coloring matter and acid, and it is then re-melted, adding from ten to twenty per cent. of any light, easily evaporating fluid, such as fusel oil, benzole, photogen, or alcohol. The paraffine is finally cast in moulds for treatment in the hydrostatic press.

The product is really very fine, and as the process is so simple, it is probable that it will come into general use. It has the same per centage and composition as olefiant gas, hence its great utility in the manufacture of candles; and it burns superior to spermaceti or wax, and mixed with either, or with the solid fat acids, it is destined to become an important branch of industry. The firm, in whose hands the manufacture of the new article now is, are making from three to six tons of it per week.

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*Vegetable Leathers.**

The *Mechanics' Magazine* gives the following account of what is being done in this direction:—

"Having seen some specimens of these leathers, as well as various articles of utility manufactured therewith, we have been induced to pay the extensive works of Messrs. Spill and Co., the eminent Gov-

* From the Journal of the Society of Arts, No. 345.

ernment contractors on Stepney-green, a visit, in order to cull sufficient to place upon record the present position of artificial as a substitute for real leather. The face and general character of the vegetable leather resembles the natural product so closely that it is only by actual examination that the difference can be determined. This is more particularly the case in that description which is made for book-binding, the covering of library tables, and like purposes. Amongst other advantages it possesses over leather proper, may be mentioned, that, however thin the imitation is, it will not tear without considerable force is exercised, that it resists all damp, and that moisture may be left upon it for any period without injury, consequently, it does not sodden or cockle, is always dry, and its polish is rather increased than diminished by friction. Add to these facts that any attempt to scratch or raise its surface with the nail, or by contact with any ordinary substance, will not abrade it, and enough will have been said to justify its entering the list against an article of daily use, which has of late years been deemed far from sufficient for the demand, and has consequently risen in price to the manifest loss and injury of every class of the community. We believe that the largest entire piece of real leather that can be cut from a bullock's hide is not more than seven feet by five, and this includes the stomach and other inferior parts. Vegetable leather, on the contrary, is now produced 50 yards in length and 1½ yards wide, every portion being of equal and of any required thickness, and the smallest portion is convertible. We were agreeably disappointed, however, to find that, instead of vegetable leather being a discovery requiring the aid of ourselves and contemporaries, it was, although so young, an active agent in the fabrication of numerous articles in daily requirement, and that it had already become the subject of large—indeed, we may say enormous—contracts. Caoutchouc and naphtha are used in its manufacture, but, by a process known to the senior of the firm, who is himself an accomplished chemist, all odor is removed from the naphtha, and the smell of the vegetable leather is rendered thereby less in strength, if anything, than that of leather. The principal objects to which it is at present applied, although it is obvious it will take a wider range of usefulness than leather itself, are carriage and horse aprons, antigropole, soldiers' belts, buckets which pack flat, harness of every description, book-binding, &c. For the latter, its toughness, washable quality, and resistance to stains render it remarkably fitted. Its thickness, which may be carried to any extent, is obtained by additional backings of linen, &c., cemented with caoutchouc, and its strength is somewhat marvellous, while in the all-important commercial view, it is but one-third the price of leather. Many of the articles we were shown possessed the appearance of much elegance and finish; but it was curious to observe that although most of these could be made without a stitch, and within the factory itself, a deference to the feelings of the workmen in the several trades has been shown by the firm, and the material is given out as ordinary leather to undergo the process of the needle, which it submits to with a greater facility than its original prototype. Perhaps this concession upon the part of the discoverers is both wise

and politic, inasmuch as their object is more to manufacture and supply the article in the gross to the saddler, &c., than to make it up on their own premises—a monopoly which might become exceedingly formidable and injurious. We think we have glanced, although hastily, at the principal features of this important discovery, and said quite sufficient to raise the curiosity of all interested in the advance and consequent cheapening of our manufactures.

For the Journal of the Franklin Institute.

Particulars of the Steamer Matanzas.

Hull and machinery built by C. H. Delamater, New York. Owners, Mora Bros., Navarro & Co. Intended service, New York to Matanzas.

HULL.—

Length on deck,	205 feet.	
" at load line,	200 "	
Breadth of beam, molded,	29 "	6 inches.
Depth of hold,	12 "	6 "
" to spar deck,	20 "	9 "

Frames—shape ⌐⌐; depth, 3½ ins.; width of web, ½-in.; width of flanches, 3½ ins.; 14 strakes of plates from keel to gunwale, ¾, ⅝, ½-in. thick.

Cross Floors—⌐ 18 in. deep × ½-in.

Keel—depth, 9 ins.; dimensions, 3 ins.

Rivets—⅞, ¾, ⅝, 3 ins. apart; double riveted.

Draft of water, (forward and aft.)	13 "	
Tonnage,	870.	

Area of immersed section at load draft of 13 ft., 320 sq. ft.

Rig, two masted schooner.

ENGINES.—Vertical direct.

Diameter of cylinder,		56 inches.
Length of stroke,	3 feet	9 "
Maximum pressure of steam,	22 lbs.	

Cut-off—one-third.

BOILER.—One—Tubular.

Length of boiler,	24 feet.	
Breadth "	16 "	
Height " exclusive of steam chimney,	11 "	1 inch.
Number of furnaces,	3.	
Breadth "	5 "	2 inches.
Length of grate bars,	7 "	6 "
Number of tubes, above, 860—flues below, 3 arches.		
Internal diameter of tubes, above,		3 "
Length of tubes, above,	3 "	4 "
Diameter of smoke pipe,	5 "	2 "
Height " above grates,	42 "	

PROPELLER.—

Diameter of screw,	14 feet.	
Length "	3 "	6 inches.
Pitch "	22 "	
Number of blades,	4.	

Remarks.—One independent steam, fire, and bilge pump. Four bulkheads. Date of trial, March, 1860. C. H. H.

Aerometry. Translated from the Hydraulics of D'Aubuisson de Voisins. By J. BENNETT.

(Continued from page 132.)

SECOND SECTION.

In this section we shall treat of the *Motion of Air* in conduit pipes. Combining the results obtained, with the principles laid down in the preceding Section, we shall calculate the effects of *Blowing Machines*.

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CHAPTER FIRST.

Motion of Air in Pipes.

516. *Resistance of Pipes. Its expression.*—If to a reservoir which is always filled with equally compressed air, we fit a long pipe whose extremity is either entirely open, or provided with an ajutage contracting the orifice, the air will enter it, will pass through, and will issue, producing a continuous blast.

If we designate by H the height of the manometer at the reservoir, it will represent the force (effort) which drives the air in the tube. If the latter opposes no resistance to its motion, it will still indicate the force which presses the issuing air; then, a second manometer, placed upon a second reservoir, containing the outlet pipe, would also be held at the height H. But this is not the case; the resistance of the pipe destroys a portion of the initial force; and the second manometer will only have a height h, a height smaller than H, and which alone produces the velocity of issue. Thus the resistance will absorb a part of the first force equal to H—h; and this quantity will thus represent the resistance.

517. As with tubes conducting water, the resistance will be an effect of the action of the sides, and it will be accordingly increased with their length, and with their circumference or diameter (184). It will also be in the inverse ratio of their section, or as the squares of the diameter; and will increase proportionally to the square of the velocity. As to the term expressing the relation between the resistance and the velocity, taken in the first power (107) it may be wholly neglected; according to Hutton's observations, its effect is insensible for velocities of air from 10 to 328 feet.* Now, in pipes, the velocity does not exceed 164 feet, and is seldom ever below 10 feet.

Consequently, if u is the mean velocity in a pipe, with a length L, and diameter D, n^1 being a constant co-efficient, we shall have

$$\text{H}-h = n^1 \frac{\text{L D } u^2}{\text{D}^2} = n^1 \frac{\text{L } u^2}{\text{D}}.$$

518. *Equation of Motion.*—The motion of air in a pipe differs in this respect from that of water, in that its velocity is not entirely uniform, but gradually increases from the commencement to the end, in the inverse ratio of the respective pressures from $b+h$ to $b+$ H, b being the height of the barometer.

* New Experiments upon Artillery, second part, translation of M. Terquem, pp. 112 and 148.

In fact, if when the permanence of motion is well established, we imagine in the pipe, two extremely thin cross sections of equal thickness, and at some distance apart, there must pass through each of them the same mass of air, and the same number of molecules in the same time. In the lower section, where the pressure, and therefore the density of the air is less, there will be at any instant, fewer molecules than in the upper; they must pass then more rapidly, and so much the more as the density is less.

The diminution of density, as well as that of pressure, being proportional to the length of pipe, will be in an arithmetrical progression; the same will be the case for the increase of the velocity. Consequently, the mean u will be at the middle of the pipe. The pressure there is $\frac{1}{2}(b + \text{H} + b + h) = b + h_1$, making $\frac{1}{2}(\text{H} + h) = h_1$ at the extremity, it is $b + h$; thus, if we designate by v, the velocity at the end, we shall have

$$u : v :: b + h : b + h_1 \text{ or } u = v\,\frac{b + h}{b + h_1}.$$

519. If the conduit is terminated by an ajutage, whose diameter of orifice is d, and with a velocity V of issuing fluid; the velocities being in the inverse ratio of the sections, or the squares of the diameter, we shall have $v = \text{V}\,\frac{d^2}{\text{D}^2}$, or more exactly $v = \frac{m\,d^2}{\text{D}^2}$, m being the co-efficient of contraction at the orifice; it will generally be ·93 in the ajutages of pipes (509). Moreover, and other things being equal, V^2 is proportional to h, or equal to $n''\,h$, n'' being another constant multiplier. Thus,

$$u^2 = n''\,h\,\frac{m^2\,d^4}{\text{D}^4}\left(\frac{b + h}{b + h_1}\right)^2;$$

this value should be substituted in the above equation.

In the second member, we shall have three constant multipliers n', n'', and m; we will represent their product by n; it may also comprise the factor $\left(\frac{b + h}{b + h}\right)^2$, variable it is true, but within very narrow limits, and the experiments giving n, will implicitly give its value for analogous cases. Consequently making $n'\,n''\,m\left(\frac{b + h}{b + h}\right)^2 = n$, we have

$$\text{H} - h = n\,\frac{h\,\text{L}\,d^4}{\text{D}^5}.$$

520. The second member expresses only the resistance of the sides; but there is another besides this, arising from the choking of the fluid vein in its passage from the reservoir into the conduit: it operates with the first in reducing the height of the manometer from H to h, and consequently in producing $\text{H} - h$; its expression, which is (204)

$$h\,\frac{m^2\,d^4}{\text{D}^4}\left(\frac{1}{m'^2} - 1\right),$$

m' being the co-efficient at inlet of the conduit, should then be introduced in the second member. But, from what has been said in Nos. 55 and 204, the effect of this contrac-

tion will be extremely small, and may be neglected in large conduits; moreover, it may be implicitly comprised in the value of n derived from experiment.

521. The height h is that of a manometer to be placed upon a reservoir at the extremity of the conduit, and is the same as that of the outlet ajutage at which the outlet ajutage is held. But, in reality, we have no such reservoir; and the extreme manometer is established directly upon the conduit itself, quite near the ajutage. The height h' to which it rises is less than h, the height really due to the velocity of issue, by a quantity equal to the height due the velocity v which the fluid has under the manometer (208 and 213) a height which is $\frac{v^2}{2g}$, or, in a column of mercury,

$$\frac{v^2}{2g}\cdot\frac{d}{D}=\frac{V^2}{2g}\cdot\frac{m^2 d^4}{D^4}\cdot\frac{d}{D}=h\frac{m^2 d^4}{D^4},$$

remembering that

$$V=\sqrt{29\,h\,\frac{D}{d}}\,(500.)$$

Thus,

$$h'=h-h\frac{m^2 d^4}{D^4}=h\left(1-\frac{m^2 d^4}{D^4}\right),$$

and consequently,

$$h=\frac{h'}{1-\frac{m^2 d^4}{D^4}};$$

and the equation of motion with h' will be

$$H\left(1-\frac{m^2 d^4}{D^4}\right)-h'=n\frac{h' L d^4}{D^5}.$$

But experiments to be shown hereafter, in which the term $\frac{m^2 d^4}{D}$ reaches as high as ·453, prove that the formula is better established, that is to say, that n is more constant in neglecting than in preserving this term, and consequently in taking the height really given by the manometer for h; or in other words, for the generating height of the velocity of issue.

522. *Determination of the Constant Co-efficient.*—We now come to the determination of n in the equation

$$H-h=n\frac{h L d^4}{D^5},$$

H and h being the heights of the manometers placed upon the conduit, the one at the origin, the other at its end immediately in front of the nozzle.

To arrive at this properly, as well as to establish the laws of resistance, I made a great number of experiments, the details of which may be found in Tomes III and IV of the *Annales des Mines*, (1828 and 1829.) I merely refer to them and confine myself to the following observations:

I had to establish at the mines of Rancié (department of Ariége,) a ventilator, which was to carry a distance of 1312 feet the air which it received from a "*trompe*," a kind of blower used at the iron works of the Pyrénées, the Alps, &c. This air was to be conducted through a tin pipe ·328 feet in diameter.

It was laid in pieces 65 6 feet in length. As soon as one of them was laid, there was fitted in succession at its end, nozzles or slightly conical ajutages, whose diameter at the orifice was ·16 ft., ·13 ft., ·098 ft., and ·065 ft., and which nearly always made with the pipe an angle of 135°. During the experiments, three different quantities of water

were let into the "*trompe*," to insure different velocities. A manometer, placed at the end of the conduit, quite near the base, made known the elastic force h of the air at its outlet; while another placed upon the reservoir of the "*trompe*" indicated the force H at the inlet of the pipe.

To establish the effect of the diameter of the pipes, I made two small conduits 183 ft. long; one had a diameter of ·164 ft., and the other ·077 ft.

From among over one thousand experiments made conjointly by myself and M. Marot, Engineer, three hundred and twenty-five reported in the "*Annales des Mines*," served for the determination of the co-efficient

$$n\left(=\frac{(H-h)\,D^5}{h\,L\,d^4}\right):$$

I give in the following tables the results of a portion of them:

Conduit of ·328 feet diameter.

Length of the conduit.	Nozzle of ·164 ft. diameter.			Nozzle of ·098 ft. diameter.		
	Manometer		Derived Co-efficient.	Manometer		Derived Co-efficient.
	At Origin.	At Extremity.		At Origin.	At Extremity.	
ft.	ft.	ft.		ft.	ft.	
330·05	·0633	·0249	·0247	·1093	·0889	·0285
394·03	·0725	·0249	·0248	·1049	·0830	·0272
457·68	·0741	·0249	·0226	·1125	·0889	·0235
524·78	·0590	·0177	·0233	·0932	·0725	·0220
589·58	·0593	·0164	·0233	·0784	·0607	·0200
654·54	·0741	·0193	·0227	·1066	·0784	·0223
720·19	·0735	·0219	·0193	·1108	·0784	·0233
784·62	·0830	·0206	·0202	·1138	·0814	·0206
849·62	·0902	·0206	·0208	·1197	·0837	·0206
917·70	·0932	·0193	·0218	·1213	·0800	·0228
984·24	·0918	·0177	·0223	·1197	·0784	·0217
1056·22	·1003	·0127	·0208	·1315	·0859	·0204
1129·50	·1007	·0164	·0239	·1302	·0830	·0204
1203·20	·1345	·0196	·0254	·1761	·1049	·0228
1270·10	·1404	·0193	·0258	·1315	·0784	·0216
	Mean, .		·0228	Mean, .		·0225

Pipe of ·164 ft. diameter. Nozzle of ·098 ft.				Pipe of ·077 ft. diameter. Nozzle of ·065 ft.			
Length of Pipe.	Manometer		Derived Co-efficient.	Length of Pipe.	Manometer		Derived Co-efficient.
	At Origin.	At Extremity.			At Origin.	At Extremity.	
ft.	ft.	ft.		ft.	ft.	ft.	
30·66	·1214	·1102	·0244	29·19	·177	·0295	·0252
63·96	·1302	·1036	·0242	57·66	·193	·0198	·0223
99·38	·1256	·0889	·0206	82·36	·185	·0128	·0238
131·88	·1214	·0859	·0238	106·99	·200	·0113	·0227
164·16	·1154	·0705	·0248	131·88	·165	·0066	·0266
182·13	·1332	·0787	·0226	165·80	·167	·0087	·0262
Mean, . . .			·0254	Mean, .			·0247

A peculiar circumstance seems to have caused the small co-efficients upon the great conduit, especially at its middle part. The mean co-efficient, with a nozzle of ·131 feet was ·022; and ·021 with that of ·065 ft. Upon the conduit of ·164 ft. with such a nozzle it was raised to ·0248.

The aggregate of all our observations gives as a mean term, $n = ·0238$.

523. *Pressure at the Extremity of Conduit.*—We shall thus have

$$\text{H}-h = \cdot 0238 \frac{h\ \text{L}\ d^4}{\text{D}^5} : \text{whence}$$

$$h = \frac{\text{H}}{1+\cdot 0238\frac{\text{L}\ d^4}{\text{D}^5}} = \frac{42\cdot 02\ \frac{\text{H}\ \text{D}^5}{d^4}}{\text{L}+42\ \frac{\text{D}^5}{d^4}}.$$

I have compared the values of h given by this formula, with those of more than three hundred observations, and the results of calculation have followed those of experiments in all their variations, high and low, whatever the given quantities of motive water, whatever the conduits and ajutages employed; when the section of the latter was ·73 of that of the former, as well as when it was but ·04. Thus, our formula, though not strictly correct in theory, has the full sanction of experiment, at least between the limits of our applications, which will be found to lie within the limits of practice.

524. *Expression of Discharge.*—Putting the above value of h in the expression of discharge (509), we have

$$\text{Q} = 6135 \sqrt{\frac{\text{T}}{b+h}} \sqrt{\frac{\text{H}\ \text{D}^4}{\text{L}+42\ \frac{\text{D}^5}{d^4}}}.$$

The air is here at the pressure $b+h$, and we may reduce it to the volume it would have under the barometric pressure of 2·493 ft., by multiplying by the ratio between these two pressures; taking, for $b+h$ and T, the mean values 2·559 ft., and 1·048 in No. 511, we have simply

$$\text{Q} = 4030 \sqrt{\frac{\text{H}\ \text{D}^5}{\text{L}+42\ \frac{\text{D}^5}{d^4}}}.$$

525. *Discharge of Pipes entirely open.*—From the manner in which our formula of discharge has been established, it would seem to be inapplicable to conduits entirely open at their extremity, or to those whose efflux is not considerably contracted by an ajutage, and where we have $d = \text{D}$. But experiment indicates that here also their application may be made without notable error. Still, as there is no contraction at the outlet, the co-efficient m (=·93) placed in the numerical multiplier of the discharge, should be taken away; and the multiplier will then be 6597 instead of 6135. Let us compare now the results of the formula with those of an experiment made by M. Girard.

This engineer made use of a gasometer employed for lighting one of the hospitals of Paris, to ascertain the discharge of a pipe, whose length was gradually increased, the pressure in the gasometer being constant: it was at ·008162 feet estimated in a column of mercury. The pipe was made of gun-barrels fitted end to end, and was ·0518 ft. in diameter; at the time of the experiments the temperature was 62·0° and the barometer indicated nearly 2·486 ft. The observed discharge

was less than the calculated in the ratio of 551 to 557 or of 989 to 1000, as may be seen in the following table.

Length of Pipe.	Discharge in 1′ according to	
	Observation.	The Formula.
feet.	cubic feet.	cubic feet.
21·58	·05085	·04905
123·29	·02023	·02136
186·43	·01737	·01741
278·99	·01444	·01426
357·65	·01165	·01260
415·18	·01084	·01168
422·46	·01077	·01162
Mean.	·01946	·01967

Thus these experiments would lower the co-efficient 6597 to 6525, and we have for open pipes,

$$Q = 6525 \sqrt{\frac{T}{b+h}} \sqrt{\frac{H\,D^5}{L+42\,D}}.$$

In such a conduit, the air issues nearly under the pressure b, and $h = o$: at the inlet the pressure is $b + H$; but H is generally small, and without error we may make $b + \frac{1}{2}H$, and even $b + H$ equal to 2·493 feet. Thus,

$$Q = 4231 \sqrt{\frac{H\,D^5}{L+42\,D}}.$$

526. *Comparison of the Discharge of Air and of Water.*—Let us compare the expression of the discharge Q in air, with that giving the discharge Q′ in water, the pressure, the length, and the diameter of the pipe remaining the same.

The discharge in great velocities is (189),

$$Q' = 37{\cdot}548 \sqrt{\frac{H'\,D^5}{L+36\,D}},$$

H′ being the height of the column of water, measuring the charge upon the pipe. Expressing H′ in column of mercury, we have $H' = 13{\cdot}6\,H$, and consequently

$$Q' = 138{\cdot}47 \sqrt{\frac{H\,D^5}{L+36\,D}}.$$

Thus, very nearly

$$Q' : Q :: 138{\cdot}47 : 4321 :: 1 : 30{\cdot}55;$$

In other words, under the same charge, the same conduit will discharge a volume of air 30·55 times greater than the volume of water.

According to the principle laid down in No. 512, the two discharges must be in the inverse ratio of the square root of the respective densities of the two fluids, and consequently (496) as 1 to

$$\sqrt{1919{\cdot}5\,\frac{T}{b+h}}, \text{ or as } 1 \text{ to } 43{\cdot}81 \sqrt{\frac{T}{b+h}},$$

or, since $b + h = 2{\cdot}493$, and $T = 1{\cdot}848$, as 1 is to 37·71.

527. *Discharge for any Gas.*—According to this principle, p being the specific weight of any gas compared with atmospheric air, we shall have the volume of gas discharged by a pipe, by dividing the above values of Q (525 and 526) by $\sqrt{p}$.

528. *Resistance of Bends.*—The curves of conduits when they are sharp and abrupt, considerably increase the resistance to motion: thus in my numerous experiments on bent pipes, seven angles of 45° have reduced the discharge by one quarter.

In these experiments I have seen the resistance increased, the same as for pipes conveying water, sensibly as the square of the velocity, and very nearly as the square of the sines of the angles. But to my great surprise, it did not increase proportionally to the number of angles; beyond a certain number it diminished; thus 15 angles reduced the discharge less than 7 of the same size. This phenomenon, and some other circumstances, have rendered fruitless my attempts to establish even approximately, an expression for the resistance of bends.

In practice, we avoid their bad effect by well-rounding such as we are compelled to make.

529. As to contractions which may accidentally occur, their resistance as in water pipes (200) is expressed by

$$h\, m^2\, d^4 \left(\frac{k^2}{m'^2\, s^2} \frac{1}{D^4} \right),$$

s being the contracted section.

530. *Examples.*—A pipe ·051805 feet in diameter, and 415·29 feet in length, is fitted to a gasometer filled with carburetted hydrogen; the height of the water manometer placed upon the gasometer is ·11099 feet; required the discharge per second.

We have $D = ·051805$ feet, $L = 415·29$ feet, $H = \frac{·11099}{13·6} = ·0081612$ feet, and $p = ·559$, and consequently,

$$Q = \frac{4231}{\sqrt{·559}} \sqrt{\frac{·0081612\ (·051805)^5}{415·29 + 42 \times ·051805}} = ·015285 \text{ cubic feet.}$$

Experiment gave ·01483.

I give below, the results of four other operations made on the same conduit. In the aggregate, they do not differ but a hundredth from those of the formula.

Length of Conduit.	Discharge according to	
	Experiment.	Formula.
feet.		
123·09	·02747	·02793
186·43	·02313	·02274
268·99	·03092	·02815
357·65	·01945	·02489

531. There is a conduit 1066 feet long, and ·39 feet diameter; it is fitted to a reservoir upon which a mercury manometer stands at ·1804 feet. What diameter must be given to the nozzle to discharge 3·88 cubic feet per second!

The equation $Q = 4030 \sqrt{\frac{H D^5}{L + 42 \frac{D^5}{a^4}}}$,

being raised to the square and transposed, becomes $d^4 = \frac{42\, Q^2\, D^5}{(4030)^2\, H D^5 - L Q^2}$;

or with the numerical quantities above given

$$d^4 = \frac{42\ (3·88)^2\ (·39)^5}{4030^2\ (·1804)\ (·39)^5 - 1066\ (3·88)^2} = ·0000549;$$

and extracting the fourth root, $d = ·1531$ feet.

(To be Continued.)

*On the Manufacture of Malleable Iron and Steel.**

By Mr. Henry Bessemer.

[Paper read before the Institution of Civil Engineers, May 24, 1859.]

Attention was directed, in the early part of the Paper, to the ordinary mode of manufacturing iron by the puddling process; in the course of which the iron, after it "came to nature," was gathered into balls, and was then removed, as quickly as possible, to the squeezer, where much of the fluid scoria, with other mechanically mixed impurities, was driven out, leaving a mass or billet of iron composed of thousands of separate fragments of metal, the entire surface of every one of which was more or less coated with dry oxide, or fluid silicate of the oxide of iron. The great pressure exerted by the squeezer sufficed to so far remove the fluid coating of the contiguous particles, as to bring their surfaces into actual contact, and consequently to effect a union at such parts. But the whole of the matter thus displaced could not find its way between the interstices of the mass, and therefore it became locked in its numerous cavities, producing points of weakness and separation in the metal. No amount of after working or rolling could wholly displace the portions of cinder, dry oxide of iron, and of sand, which thus became mixed up with and were diffused throughout the mass, causing flaws and cracks in the iron, all more or less objectionable.

Now, if these imperfections were the natural and inevitable consequences of the conditions under which malleable iron was at present produced, it followed that defects of a similar character must also of necessity exist in steel produced by the puddling process. The granular condition of the metal, and its exposure to heat and oxygen, could not fail, in both cases, to oxidize the entire surfaces of the numerous molecules to be united into one mass; the admixture of scoria and other matters from the furnace, was equally certain to result; and also the difficulty of bringing each particle of the metal to the same degree of decarbonization and refinement existed as in the making of iron, with the additional inconvenience arising from some portions of the metal becoming entirely decarbonized, and being converted into soft malleable iron.

Iron thus presented a most unfavorable contrast with the other malleable metals, all of which were free from sand or scoria; they had no hard and soft parts, and required no welding together of separate molecules, but they were perfectly homogeneous and free from all mechanical admixture with foreign substances. Gold, silver, copper, zinc, tin, and lead, owed this valuable exemption from the defects universally found in puddled iron, simply to the fact that they were purified and refined in a fluid state, and, while still fluid, were formed into ingots, whereby the cohesion of every particle in the mass was insured. If, then, the refining of other malleable metals, while in a fluid state, and their formation into cast ingots, rendered all such metals more sound and homogeneous than iron, while it did not lessen their extreme

* From the Lond. Artizan, July, 1859.

ductility, why should iron for ever remain an exception to the general rule? It might be truly answered that hitherto the excessively high temperature required to fuse and to maintain pure iron in a fluid state, had interposed an insuperable barrier, for the highest heat of the furnaces only sufficed to show that fluidity was a possible condition of that metal.

It need not, therefore, be a matter of surprise that when Mr. Bessemer first proposed to convert crude pig iron into malleable iron, while in a fluid state, and to retain the fluidity of the metal for a sufficient time to admit of its being cast into moulds without the employment of any fuel in the process, his proposition was looked upon by many as a chimera, or as the mere day-dream of an enthusiast; but it was, nevertheless, fully recognised and supported by many of the scientific men of the day. The same deep conviction of the truth on which the new process was based, and which led Mr. Bessemer to bring it before the British Association in 1856, had since determined him (in spite of the opinions then pronounced against the process) to pursue one undeviating course until the present time, and to remain silent for years under the expressed doubts of those who predicted its failure, rather than again bring forward the invention until it had been practically and commercially worked, and there had been produced by it both iron and steel of a quality which could not be surpassed by any iron or steel made by the tedious and expensive processes now in general use.

The want of success which attended some of the early experiments was erroneously attributed by some persons to the "burning" of the metal, and by others to the absence of cinder, and to the crystalline condition of cast metal. It was almost needless to say, that neither of the causes assigned had any thing to do with the failure of the process in those cases where failure had occurred. Chemical investigation soon pointed out the real source of difficulty. It was found that although the metal could be wholly decarbonized, and the silicum be removed, the quantity of sulphur and of phosphorus was but little affected; and, as different samples were carefully analyzed, it was ascertained that red shortness was always produced by sulphur when present to the extent of 1-10th per cent., and that cold shortness resulted from the presence of a like quantity of phosphorus; it therefore became necessary to remove those substances. Steam and pure hydrogen gas were tried with more or less success in the removal of sulphur, and various fluxes composed chiefly of silicates of the oxide of iron and manganese, were brought in contact with the fluid metal during the process, and the quantity of phosphorus was thereby reduced. Thus many months were consumed in laborious and expensive experiments; consecutive steps in advance were made, and many valuable facts were elicited. The successful working of some of the higher qualities of pig iron caused a total change in the process, to which the efforts of Messrs. Bessemer and Longsdon were directed. It was determined to import some of the best Swedish pig iron, from which steel of excellent quality was made, and tried for almost all the uses for

which steel of the highest class was employed. It was then decided to discontinue, for a time, all further experiments, and to erect steel works at Sheffield for the express purpose of fully developing and working the new process commercially, and thus to remove the erroneous impressions so generally entertained in reference to the Bessemer process.

In manufacturing tool steel, the highest quality, it was found preferable for several reasons to use the best of Swedish pig iron, and, when converted into steel by the Bessemer process, to pour the fluid steel into water, and afterwards to remelt the shotted metal in a crucible, as at present practised in making blister steel, whereby the small ingots required for this particular article were more perfectly and more readily made.

It was satisfactory to know that there existed in this country, vast and apparently inexhaustible beds of the purest ores fitted for the process. Of the hematite alone 970,000 tons were raised annually, and this quantity might be doubled or trebled whenever a demand arose. It was from the hematite pig iron made at the Workington Iron Works, that most of the larger samples of iron and steel exhibited were made. About 1 ton 13 cwt. of ore, costing 10 s. per ton, would yield 1 ton of pig metal, with 60 per cent. less lime and 20 per cent. less fuel than were generally consumed when working inferior ores; while the furnaces using this ore alone yielded from 220 to 240 tons per week, instead of, say 160 to 180 tons per week when working with common iron stone. The Cleator Moor, the Weardale, and the Forest of Dean Iron Works, also produced an excellent metal for this purpose.

The form of converting vessel which had been found most suitable, somewhat resembled the glass retort used by chemists for distillation. It was mounted on axes, and was lined with "Ganister" or road drift, which lasted during the conversion of thirty or forty charges of steel, and was then quickly and cheaply repaired or renewed. The vessel was brought into an inclined position to receive the charge of crude iron, during which time the tuyeres were above the surface of the metal. As soon as the whole charge was run in, the vessel was moved on its axes so as to bring the tuyeres below the level of the metal, when the process was at once brought into full activity, and twenty small though powerful jets of air sprung upwards through the fluid mass; the air expanding in volume divided itself into globules, or burst violently upwards, carrying with it a large quantity of the fluid metal, which again fell back into the boiling mass below.

The oxygen of the air appeared in this process, first, to produce the combustion of the carbon contained in the iron, and, at the same time, to oxidize the silicum, producing silicic acid, which, uniting with the oxide of iron, obtained by the combustion of a small quantity of metallic iron, thus produced a fluid silicate of the oxide of iron or "cinder," which was retained in the vessel, and assisted in purifying the metal. The increase of temperature which the metal underwent, and which seemed so disproportionate to the quantity of carbon and iron consumed, was doubtless owing to the favorable circumstances under

which combustion took place. There was no intercepting material to absorb the heat generated and to prevent its being taken up by the metal, for heat was evolved at thousands of points distributed throughout the fluid, and when the metal boiled the whole mass rose far above its natural level, forming a sort of spongy froth, with an intensely vivid combustion going on in every one of its numberless ever-changing cavities. Thus, by the mere action of the blast, a temperature was attained in the largest masses of metal in ten or twelve minutes, that whole days of exposure in the most powerful furnace would fail to produce.

The amount of decarbonization of the metal was regulated with great accuracy by a metre, which indicated on a dial the number of cubic feet of air that had passed through the metal; so that steel of any quality or temper could be obtained with the greatest certainty. As soon as the metal had reached the desired point (as indicated by the dial), the workmen moved the vessel so as to pour out the fluid malleable iron or steel into a founder's ladle, which was attached to the arm of a hydraulic crane, so as to be brought readily over the moulds. The ladle was provided with a fire-clay plug at the bottom, the raising of which, by a suitable lever, allowed the fluid metal to descend in a clear vertical stream into the moulds. When the first mould was filled, the plug valve was depressed, and the metal was prevented from flowing until the casting ladle was moved over the next mould, when the raising of the plug allowed this to be filled in a similar manner, and so on until all the moulds were filled.

The casting of large masses of a perfectly homogeneous malleable metal into any desired form, rendered unnecessary the tedious, expensive, and uncertain operation of welding now employed wherever large masses were required. The extreme toughness and extensibility of the Bessemer iron was proved by the bending of cold bars of iron, 3 ins. square, under the hammer into a close fold, without the smallest perceptible rupture of the metal at any part; the bar being extended on the outside of the bend from 12 ins. to 16¾ ins., and being compressed on the inside from 12 ins. to 7¼ ins., making a difference in length of 9½ ins. between what, before bending, were the two parallel sides of a bar 3 ins. square. An iron cable consisting of four strands of round iron, 1½ ins. diameter, was so closely twisted while cold, as to cause the strands at the point of contact to be permanently imbedded into each other. Each of these strands had elongated 12½ ins. in a length of 4 ft., and had diminished one-tenth of an inch in diameter, throughout their whole length. There were also exhibited some steel bars, 2 ins. square, and 2 ft. 6 ins. in length, twisted cold into a spiral, the angles of which were about 45 degrees; and some round steel bars, 2 ins. in diameter, bent cold under the hammer, into the form of an ordinary horse-shoe magnet, the outside of the bend measuring 5 ins. more than the inside.

The steel and iron boiler plates, left without shearing and with their ends bent over cold, also afforded ample evidence of the extreme tenacity and toughness of the metal; while the clear even surface of the

railway axle and piece of malleable iron ordnance, were examples of the perfect freedom from cracks, flaws, or hard veins, which formed so distinguishing a characteristic of the new metal. The tensile strength of this metal was not less remarkable, as the several samples of steel tested in the proving machine at Woolwich Arsenal, bore, according to the reports of Colonel Eardley-Wilmot, R. A., a strain varying from 150,000 lbs. to 162,900 lbs. on the square inch, and four samples of iron boiler plate, from 68,314 lbs. to 73,100 lbs.; while, according to the published experiments of Mr. W. Fairbairn, Staffordshire plates, bore a mean strain of 45,000 lbs., and Low Moor and Bowling plates, a mean of 57,120 lbs. per square inch.

There was another fact of great importance in a commercial point of view. In the manufacture of plates for boilers and for ship-building, the cost of production increased considerably with the increase of weight in the plate; for instance, the Low Moor Iron Company demanded £22 per ton for plates weighing 2½ cwt. each, but if the weight exceeded 5 cwt., then the price rose from £22 to £37 per ton. Now, with cast ingots such as the one exhibited, and from which the sample plates were made, it was less troublesome, less expensive, and less wasteful of material, to make plates weighing from 10 to 20 cwt. than to produce smaller ones, and, indeed, there could be but little doubt that large plates would eventually be made in preference, and that those who wanted small plates would have to cut them from the large ones. A moment's reflection would therefore show the great economy of the new process, in this respect; and, when it was remembered that every riveted joint in a plate reduced the ultimate strength of each 100 lbs. to 70 lbs., the great value of long plates for girders, and for ship-building, would be fully appreciated.

At a time when the manufacture of ordnance occupied so large a share of public attention, it was interesting briefly to point out the great facility which the Bessemer process afforded of forming masses, both of malleable iron and of steel, of a size suitable for the heaviest ordnance, without any welding together of separate slabs, or the more costly mode of building up the gun with pieces accurately turned and fitted together. Many attempts had been made to produce wrought iron ordnance, and this object had been successfully accomplished in the case of the large gun produced at the Mersey forge. But, however perfect this one gun might be, the time required to make it, and its immense cost, manifestly rendered it still a great desideratum to produce guns rapidly and cheaply of a material equal to, or greater in tensile strength than wrought iron, and, if possible, free from the liability which that material had to flaws and to deterioration, during its long exposure to a welding heat. It was believed that the Bessemer process supplied this desideratum, as masses of cast malleable metal could be produced of 10 or 20 tons in weight in a single piece, and two or three such pieces might be conveniently made by the same apparatus in one day. The metal so made might be either soft malleable iron or soft steel. In order to prove the extreme toughness of such iron, and the strain to which it might be subjected without burst-

ing, several cast and hammered cylinders were placed cold under the steam-hammer, and were crushed down without the least tearing of the metal, as was shown by the samples exhibited. These cylinders were drawn from a round cast iron ingot of only 2 ins. greater diameter than the finished cylinder, and in the precise way in which a gun would be treated; they might, therefore, be considered as short sections of an ordinary 9-pounder field-piece. The tensile strength of the samples, as tested at the Royal Arsenal, was 64,566 lbs. per sq. in., while the tensile strength of pieces cut from the Mersey gun gave a mean of 50,624 lbs. longitudinally, and 43,339 lbs. across the grain; thus showing a mean of 17,550 lbs. per square inch in favor of the Bessemer iron.

If it was desired to produce ordnance by merely casting the metal, the ordinary founding process might be employed with the simple difference, that the iron, instead of running direct from the melting furnace into the mould, must first be run into the converting vessel, where in ten minutes it would become steel or malleable iron, as was desired, and the casting might then take place in the ordinary manner. The small piece of ordnance exhibited served to illustrate this important manufacture; and it was interesting in consequence of its being the first gun that was ever made in malleable iron without a weld or joint. The importance of this fact would be enhanced when it was known that conical masses of this pure tough metal, of from 5 to 10 tons in weight, could be produced at Woolwich at a cost not exceeding £6 12s. per ton, inclusive of the cost of pig iron, carriage, remelting, waste in the process, labor, and engine power. The conical ingots being cast in iron moulds, the great delay in moulding in loam would be avoided; and as the iron moulds employed might be removed from the casting pit within an hour after the metal had been poured into them, the tedious interval of three days now required by the cast iron guns before removal would be also avoided, thus immensely increasing the capabilities of the foundry.

If it was assumed that these advantages were about equal to the cost of hammering the cast ingot, then, by this process, it would be practicable to produce guns of any size, in hammered cast steel, or malleable iron ready for the boring mill, at about the same cost as the cast iron guns now in use; but if the weight of the guns could be reduced by 20 or 25 per cent., in consequence of their superior strength, then an actual saving in that proportion would be effected in the first cost of every gun so made. These important facts had been laid before the government, and their advantages were stated to be fully appreciated by Colonel Eardley-Wilmot, the superintendent of the Royal Gun Factories, who had evinced a great interest in the progress of the invention from its earliest date, and to whose kindness the author was indebted for the many valuable trials of the tensile strength of the various samples of metal that had been submitted for investigation.

It would be interesting to those who were watching the advancement of the new process to know that it was already rapidly extending itself over Europe. The firm of Daniel Elfstrand & Co., of Edsken, who

were the pioneers in Sweden, had now made several hundred tons of excellent steel by the Bessemer process. Another large manufactory had since been started in their immediate neighborhood, and three other companies were also making arrangements to use the process. The authorities in Sweden had fully investigated the whole process, and had pronounced in favor of it. The large steel circular saw plate exhibited, was made by Mr. Göranson, of Geffle, in Sweden, the ingot being cast direct from the fluid metal, within fifteen minutes of its leaving the blast furnace. In France, the process had been for some time carried on by the old established firm of James Jackson & Son, at their steel works, near Bordeaux. This firm was about to manufacture puddled steel on a large scale. They had already got a puddling furnace erected and in active operation, when their attention was directed to the Bessemer process, the apparatus for which was put up at their works last year; and they were now extending their field of operations by putting up more powerful apparatus at the blast furnaces in the Landes. There were also four other blast furnaces in the South of France in the course of erection, for the express purpose of carrying out the new process.

The irons of Algeria and Saxony had produced steel of the highest quality.

Belgium was not much behind her neighbors; the process was now being carried into operation at Liege, where excellent steel had been made from the native coke iron; while in Sardinia preparations were also being made for working the system. Russia had sent to London an engineer and a professor of chemistry to report on the process, and Professor Müller of Vienna, and M. Dumas and others from Paris, had visited Sweden to inspect and report on the working of the new system in that country.

The Bessemer process might, therefore, be now fairly considered an accomplished commercial fact, and in a country like England, where the manufacture of iron and steel formed so important a branch of the national industry, and was so necessary an element in all the great manufacturing operations, it must be admitted that an impartial examination of the new system was of the highest importance, not only to those immediately concerned in the production of malleable iron and steel, but to the country generally.

That the process admitted of further improvement, and of a vast extension beyond its present limits, the author had no doubt; but those steps in advance would, he imagined, result chiefly from the experience gained in the daily commercial working of the process, and would most probably be the contributions of the many practical men who might be engaged in carrying on the manufacture of iron and steel by this system. Hitherto the process had been brought into its present practical and commercial state, without recourse to any of the numerous inventions which were supposed by the several authors to be essential to the success of the system; but any real improvement that might be brought forward would be cordially received and encouraged.

*Robertson's Patent Chain Propeller.** By PETER SPENCE.

[Read before the British Association, 1859.]

At the request of the patentee and several gentlemen engaged in bringing this invention into practical operation, I have undertaken to give a short description of it to the Mechanical Section of the British Association.

It is well known that great efforts have been made to adapt steam power to the conveyance of both passengers and goods on canals, but although the failure of most of these efforts is apparent, from the fact that on a very few canals is it at this moment employed, yet there seems no reason to doubt that if steam power can be made to suit itself to the peculiarities of canal navigation, it will be found, as in every other department of mechanics, the cheapest and most convenient agent.

In 1831, when the first efforts seem to have been made to employ steam power on canals, Mr. Fairbairn, who was then engaged in an extensive series of experiments by which much valuable data was elicited, recommended for this purpose a peculiar form of steamboat with paddles in the stern; but however well these boats might otherwise have fulfilled the design, the surge from every form of paddle steamboat was no doubt the fatal barrier to their adoption. When at a later period the screw was adopted as a propeller, this seemed to meet the difficulties of the case, and screw propelled boats have to some extent been adopted and are now in use: but even the screw has been found only applicable to the few canals which are of considerable depth; and in these the danger always exists of a disturbance producing a disintegrating effect on the sides and bottom of the canal, and where, as in the majority of canals, the depth does not exceed 3 to 4 feet, the working of the screw is found to be altogether impracticable.

The invention of Mr. Robertson fully meets and obviates these difficulties arising from the use of both the paddle and the screw, while it possesses advantages in obtaining the full effect of the power applied, which are apparent at once. In whatever mode power is applied to the propulsion of vessels in water, by the paddle or screw, there is a great loss of power, only a part being productive, and the remainder wasted. For example, when the paddle is just entering the water on the one side, and leaving or emerging from it on the other, the powers expended in these actions only neutralize each other, and contribute nothing to the propelling of the vessel. So great is the loss of power in some circumstances, that one authority gives the following example:—Suppose a boat propelled in a stream, the power being affixed or applied to a cylinder on which a rope is wound, the other end of the rope being attached to a fixed point at some distance up the stream or on shore; and that the power is afterwards applied by paddles in the stream: it will, he says, take three times the motive power in the latter case that it does in the former to propel the vessel at the same speed. This, I think, must be an exaggerated estimate; but it clearly proves the great loss of power in certain cases, and the probability that it is considerable in all.

*From the Civ. Eng. and Arch Jour., Dec., 1859.

The peculiar principle of Mr. Robertson's invention is, that he applies the power by dragging the vessel from a fixed point, and its great ingenuity is, that the fixed point is at the same time a moveable one,—a constantly fixed point in relation to the power exerted in propelling the vessel, and a constantly changing point in relation to the course on which the vessel is being propelled. The construction of the propelling apparatus is as follows:—At or near the bows of a boat, say 70 feet long, is placed a steam engine, the main shaft of which crosses the bows of the vessel at or about the level of the deck; a fixed pulley is attached to each end of this shaft, these pulleys projecting over the sides of the vessel; they are 3 feet or more in diameter, and on their periphery have a hollow or groove to receive the chains which are to run over them; they are also so constructed as to take firm hold of the chains as the power is exerted in dragging them over the pulleys. On the other or the stern end of the boat are two pulleys, also projected over, one on each side; these are loose, so that the chains merely run over them. Friction rollers are also placed along each side of the vessel, to carry the chains as they pass from the stern to the bows of the vessel; the chains, which are endless, pass or are dragged over fixed pulleys at the bow of the vessel, and falling down lie along the bottom of the canal, and thus become the fixed point or lineal anchor on which the power acts; the action of the engine in dragging the chain over the loose and fixed pulleys being necessarily to drag or propel the boat forward. Every yard of the chain passed over the pulleys representing a yard of space that the boat has progressed in her course—the fixed point or length of chain lying at the bottom of the canal still remaining the same, what is taken up at the stern being replaced by exactly the same length deposited at the bow. The speed of the vessel is thus exactly equivalent to the speed and size of the driving pulleys, unless, indeed, there should be any slip of the chain in passing over them, and this in practice is easily prevented, and is again exactly measured by the velocity of the chain, unless there should be a slip of the chain along the whole length over the bottom of the canal, and this, of course, is a mere matter of the weight of the chain. In repeated trials which have been made before thousands of spectators (and in more than one of which the writer was on board), in a boat 70 feet long and 7 feet wide, the chain used was only 20 lbs. per yard, or 40 lbs. per yard for the two chains, 22 yards of double chain being always at the bottom; this gives a weight or resistance of 880 lbs. in this case as the fixed point. From the data ascertained by Mr. Fairbairn, that in tugging vessels the average pull of a horse was 94 lbs., the fixed point in these trials would exceed nine horses' power, and an engine power of nine horses could therefore be exerted without the chain slipping over the bottom of the canal. The speed attained ranged from 4 to 6 miles per hour, and nothing more was attempted at that time; the motion was easy and regular, the facility for starting equal to either screw or paddle, and the power of stopping quite peculiar. The moment the engine stops she drags at anchor, and the momentum is absorbed before the vessel has proceeded one-half of her own length.

The weight of the chain can be doubled or quadrupled without inconvenience, and the capability of using increased power to any extent be afforded as required. The weight of chain when increased does not materially increase the loss of power, as the power expended in raising the chains at the stern is neutralized by the weight of the falling chain at the bows, the only loss of power being the friction on the pulleys and friction rollers as the chains pass from stern to stem of the boat above water, and that must be so trifling as not to merit calculation. The invention is not limited in its application to canals, but is suited to rivers where occasional shallowness may render either paddles or screw useless, or where a strong current would prevent any amount of power being got except at an enormously increased and therefore impracticable speed. No additional speed, but only an additional power, would be required by the chain propeller to stem the strongest current; and however shallow, if the boat will float the propeller will work.

It is almost needless to add that the working of the chain gives rise to none of that commotion in the water that constantly attends the working of both paddles and screw; the chains rise and fall without the least perceptible agitation of the water, and even the ordinary wave from the bow of the boat is cut in pieces by the falling chain and reduced to the merest ripple.

Proceedings of the British Association for the advancement of Science.

29th Annual Meeting, Sept., 1859. (Continued from page 117.)

SECTION G.—*Mechanical Science.**

Monday, 19th.—"On a New Gas-Burner, and a Method of producing an Illuminating Gas cheaply from the Decomposition of Water," by the Abbé MOIGNO.

"On an Automatic Injector for feeding Boilers," by Mr. GIFFARD.

"On a Helico-Metre, an Instrument for Measuring the Thrust of the Screw-Propeller," by the Abbé MOIGNO.

"On an Application of the Moving Power arising from Tides to Manufacturing, Agricultural, and other Purposes, and especially adapted to obviate the Thames Nuisance," by Dr. SEGUIN.

"Description of the Granite Quarries of Aberdeen and Kincardineshire,' by Mr. A. GIBB.—The working of the quarries in Aberdeen commenced 250 years ago; but little progress was made for 100 years. The houses in Aberdeen were constructed principally of wood till 1741, when a fire taking place, the town-council ordained that the fronts of the houses should be built of stone or brick. In 1764 granite was recommended for paving the streets of London, and was used for Waterloo Bridge in 1817, and subsequently for the docks at Sheerness and London Bridge. There are upwards of twenty quarries supplying the different varieties of granite: the blue, the red or Peterhead granite, the light red, soft grey, and white. The granite, for the most part, lies in irregular masses in the quarries, and generally of columnar structure. The quarrying is principally carried on by blasting. The

* From the Lond. Athenæum, Oct., 1859.

drainage of the quarries is chiefly accomplished by means of siphons of lead-pipe, from 1 to 2 or 3 inches in diameter. The author suggests the use of a locomotive engine on rails for drainage purposes, as well as for crane and lifting work. The quarries are not worked to any great depth, though the best and largest masses are found at the lower depths; and proper mechanical contrivances for working deeper might be used with advantage. With reference to the durability of the granite, there appears no appreciable decay; on the oldest specimens of several hundred years the tool-marks are as sharp and fresh as at first. The tools used in dressing the granite for a long period were hammers, picks, and axes only; but in 1820 steel chisels were introduced, which effected a considerable improvement. Machinery was tried for dressing, but it failed, being in the form of a planing machine, the granite requiring a distinct blow to separate the parts. The number of workmen employed in the quarries is about 500 daily, and the number of horses about 50. About 50,000 tons are quarried annually, of which about 30,000 are exported; and the export is increasing at the rate of 500 tons annually.

"On a New Gas-Metre, with a Description of an Improved Method of obtaining a true Liquid Level," by Mr. A. ALLEN.

"On the Comparative Value of Propellers, with a Description of a Direct-Acting Propeller," by Mr. J. ROBB.

Mr. R. ROBERTS maintained that the screw and the paddle-wheel were not so imperfect in their action as Mr. Robb considered them; and he was of opinion that the paddle-wheel with radial floats was more effective than that with feathering floats. He considered a well-made screw as the most effective propeller. Mr. Robb's propeller was not new, and would soon go to pieces.—Mr. OLDHAM had seen the same thing tried and fail.—Mr. W. SMITH said a similar propeller had been made eighteen years ago, when it failed.—Mr. NEILSON did not agree with Mr. Roberts as to the relative merits of the radial and feathering paddles. In his experience the feathering wheels were the best.—Sir E. BELCHER said, that the vibration caused by the paddle-wheel arose from the back action on leaving the water, and not on entering.—Mr. OLDHAM thought that the friction gearing would be of value in driving the screw in the place of direct-acting engines.—Mr. NEILSON had had experience in friction gearing, and approved it. It was exciting much interest among the engineers on the Clyde.—Mr. G. RENNIE stated that he had tried friction gearing in the *Archimedes*, but it had failed.—Mr. DIXON had seen it tried in some rolling-mills, but it did not succeed.—Mr. W. FAIRBAIRN thought that it was worth consideration; though he feared that the great pressure necessary would cause much friction on the shaft, and thus waste power.

An experimental illustration of the Gyroscope was given by Mr. A. GERARD, who endeavored to explain its action by reference to more elementary principles of mechanics than were usually assumed for the purpose.

Tuesday, 20th.—"Experimental Researches to determine the Density of Steam at various Temperatures," by Mr. W. FAIRBAIRN.*

* See Journal of the Franklin Institute, page 17.

Prof. MACQUORNE-RANKINE and Dr. JOULE expressed their opinion of the great value of Mr. Fairbairn's researches, and trusted that he would continue them.

"On the Steam Machinery of the *Callao*, *Bogota*, and *Lima*," by Mr. J. ELDER.

"On Surface Condensation," by Dr. J. P. JOULE.—The author described the experiments he had made on this important subject. A peculiar arrangement he had introduced gave a very increased effect to a given surface. In this arrangement a copper spiral was placed in the water spaces. The spiral had the effect of giving the water a rotary motion, which was thus compelled to travel over a larger surface than it would otherwise. He also pointed out that he had succeeded in producing a better vacuum than the temperature of the condensing and condensed water appeared to warrant, and that thus a fresh and unexpected advantage was proved to belong to the system of surface condensation.

A discussion took place, in which Prof. MACQUORNE-RANKINE, Messrs. A. TAYLOR and W. SMITH took part; and a wish was expressed that Dr. JOULE would continue his important researches and give the results at a future meeting.

"On a Submarine Lamp," by Mr. RETTIE.

Mr. C. BARNETT explained the arrangement of his lamp for the same purpose.

"On the Advantages of the 40-inch Metre as a Measure of Length," by Mr. G. JOHNSTONE STONEY.—The author showed that if a 40-inch metre was adopted it could readily be decimalized and the inch retained, and thus all difficulty in the comparison of the old and new measure would be avoided. The tenth would be four inches, which he would call a hand, the hundredth he would call a nail, and the one-thousandth he would call a line. The old yard would thus be nine hands, a foot would be three hands, and one inch would equal twenty-five lines.

"On Gas Carriages, for lighting Railway Carriages with Coal Gas instead of Oil," by Mr. G. HART.

"On Coal-Pit Accidents," by Capt. J. ADDISON.

"On a Deep Sea Pressure Gauge," by Mr. H. JOHNSON.

Sir E. BELCHER explained an instrument constructed under his direction some years since for ascertaining the depth of water by compression, and also the temperature and the quality. He pointed out the difficulties to be got over in the construction of such instruments, and how he had succeeded in obviating them. His (Sir E. Belcher's) instrument had been tested to 1200 fathoms, and proved successful.

"On a Patent Disc Pan for evaporating Saccharine Solutions and other Liquids at a Low Temperature," by Mr. DAVIS.

Mr. A. TOPP described various Models of Fire-Escapes, Boats, &c.

"On Indian River Steamers and Tow-Boats, giving an Account of their improved Construction for Light Draft, capability for Cargo, and Fittings conducive to Managability in Shallow Rapid Rivers, &c., and of the Practical Value of the Dynamometer in showing the Resistance of Vessels in Tow, at Different Speeds and Loads, with the Result of Test-Trials made in England," by Mr. A. HENDERSON.

For the Journal of the Franklin Institute.

Collection of Observations on the Day-light Meteor of Nov. 15, 1859, *with remarks on the same.* By BENJAMIN V. MARSH.

This meteor made its appearance at about half past 9 o'clock, A. M., (New York time,) the weather being perfectly clear, and the sun shining brightly.

It was *seen* at Salem, Boston, and New Bedford, Mass.; Providence, R. I.; New Haven, and many other places in Conn.; New York City; Paterson, Medford, and Tuckerton, N. J.; Dover, and other places in Delaware; Washington City; Alexandria, Fredericksburg, and Petersburg, Virginia.

It was *heard* at Medford, New Jersey, and at *all* places in that State, south of a line joining Tuckerton and Bridgeton, and throughout nearly the whole of Delaware.

With perhaps two or three exceptions, it was *not seen* by any one in New Jersey, south of the Camden and Atlantic Railroad; that is to say, *throughout the very region where the report was loudest.*

Many persons there, saw a momentary flash of light "like the reflection of the sun from a looking-glass," but could not tell where it came from.

The appearance of the meteor at different places is described as follows:—

Salem, Mass.

Francis F. Wallis, pilot, saw it as he was rowing across the harbor. He says, "When first seen, it was bearing about S. W. at an elevation of about 45°. Its path was nearly a straight line, making an angle of about 40° with the vertical, tending westward. Its apparent size, one-sixth the surface of the full moon—its appearance, that of a star, and quite brilliant—color, light red—leaving a train like that of a rocket, which was visible nearly the entire time, from the meteor's first being seen, until it disappeared behind the land, which probably had an elevation of three degrees. The train was of a pale reddish hue—time, from five to eight seconds—no sound heard."

Boston, Mass.

"E. F. Kinsman saw a meteor fall in the woods, in the south part of Natick—a circular luminous body terminating in a cone-like appendage. The woods were searched, but no trace found."

Pawtucket, R. I.

Mr. Blanding says, "It appeared to fall into Narragansett Bay, near the city of Providence. When first seen, it was near the zenith, and it passed down with great velocity, until beyond his vision—the sun was shining brightly."

Middletown, Conn.

A passenger on the stage from Middletown to New Haven, says, "A ball of fire was seen to descend, with a gentle lazy motion, to the earth, within a few hundred yards of the stage. We made search, but found nothing. The light was peculiarly white, and the motion somewhat undulatory."

New Haven, Conn.

It was seen by several persons, whose observations have been carefully investigated by E. C. Herrick of Yale College, who says, "Judge W. W. Boardman was standing on the sidewalk in such a position that the meteor's path is excellently determined by means of terrestrial objects. On going to the place which he occupied, it is found, by compass and quadrant, that the bearing of the meteor, when first seen, was S. 29° W. at an elevation of 15° to 18°, that it shot obliquely down towards a more westerly point, making an angle of about 33° with the vertical, and disappeared behind a steeple, at an altitude of 6°, bearing S. 35° 34′ W. The meteor did not pass the steeple, which is quite narrow, and here subtends an angle of about two degrees. I cannot be sure of the angle made with the vertical within 5° or 10°. The meteor was not more than two, probably not over one and a half seconds in sight, and appeared about as large as the full moon. An observer in the northern part of the city, where there was no material obstruction, saw the meteor disappear above a distant house, the top of which I have ascertained to be just 2° above his horizon. The place of disappearance may have been a half or one degree higher."

Mr. H. also mentions an observer on the Woodbridge hills, who saw it disappear above the horizon.

Hartford, Conn.

The *Hartford Courant* says it was seen by E. D. Tiffany, and that "It appeared to him about two feet in diameter, with a luminous appendage differing from the tail of a comet, inasmuch as it tapered from the nucleus. He was so certain that a few minutes search would have found the meteor, that only want of time prevented his attempt to bring it home as a trophy. It is certain 'the thing' fell upon Connecticut soil."

On the Hudson near Fort Washington.

Capt. Adams, of the schooner *Tryall*, says, "I saw what seemed to be a ball of fire about as large as a man's hat, coming almost directly towards my vessel, from an angle of about 45°. It left a wake or tail of about 15 feet in length, clearing the vessel but a few feet, and struck the water with a hissing sound about fifty yards off our port bow, and was lost to sight."

New York.

It was seen by great numbers, nearly all of whom appear to have thought it fell very near them. The police in the Central Park thought it fell within that enclosure.

The *Post* says, "Nucleus 1 foot in diameter, and the length of the tail, by the same scale, about 20 feet; the shape being a cone tapering to a fine point at top. The color was that of a bright yellow fire, and its brilliancy may be estimated by the fact that this color developed itself above the brightness of the sun, shining at the time through a cloudless sky. It disappeared behind the houses so abruptly, that it must have struck the earth very near the city."

The *Times* says, "Resembling in shape an inverted balloon, with a a tail 100 feet in length trailing after it."

A gentleman on the Elizabethport steamer, was sure that it fell within a few feet of the stern of that vessel.

Prof. Loomis, in the January number of *Silliman's Journal*, from the estimates of several observers at New York, concludes that the point of the horizon where the meteor vanished, was 21° west of south, that the length of its visible path was from 15° to 25°, and that the entire period of its visibility did not exceed one or two seconds.

Newark, N. J.

Henry J. Mills estimated the inclination of the meteor's path to the vertical, to be about 45°.

Medford, N. J.

Robert B. Stokes was standing on the sidewalk in the shadow of the Burlington County Bank, engaged in conversation, when he saw the meteor *over* the building. Chas J. Allen, of Philadelphia, has recently visited the spot, and measured the bearings and elevations, as pointed out to him by Mr. S.

He states that Mr. S. was on the *east* side of a street which runs S. 1¾ W. and was looking eastward. Thinks the meteor when first seen was almost due east (which would require it to have had an elevation of at least 59° and probably 65°), but this direction is uncertain. If exactly south-east, the elevation may not have exceeded 48°. Mr. A. is inclined to adopt 30° S. of E. as the most probable direction of first appearance, at an elevation of about 58°.

It shot down towards the south, and disappeared behind a house about 500 feet distant, on the *west* side of the street, bearing S. 9½ W. at an altitude of 2½°.

Mr. S. thinks he remained in the open air three minutes longer, and then went into a house without having heard any report.

The sound was heard by many persons in that vicinity. One lady who was in the house heard it, and ran out thinking the chimney was on fire.

George Haines noted the time immediately after the sound *ceased*, and after making allowance for probable error of his watch, makes the time 9 35 A. M. He estimates its duration at two minutes.

Tuckerton, N. J.

Theophilus T. Price says, "A few persons in this vicinity saw a 'ball of fire,' as they express it, pass apparently from a very high region of the heavens, and from nearly overhead, and descend towards the earth in a south-westerly direction, very far off.

"Others saw only a flash of light, while a very large majority of those who heard the rumbling noise, saw nothing unusual previously. The concurrent testimony of those who saw the flash, or the meteor itself, fixes the time that elapsed between the appearance and the report, at between three and four minutes. This would make its distance from this place between forty and fifty miles, which agrees very well with other circumstances known in reference to it.

"At the time the event occurred, a number of workmen were repairing a bridge over Wading River, nine miles westward of this place. The foreman, a man of veracity and intelligence, informed me that

himself and those that were with him, had a distinct view of the fall of the meteor. There being very little wind, the surface of the river was smooth, and, while busily engaged above it, they were suddenly startled by a flash of light upon the water beneath them, and looking up, beheld a 'ball of fire' receding and descending in the distant south-west. The foreman looked at his watch, and remarked that it was twenty minutes to ten o'clock. Presently, they were again startled by the roaring, rumbling, or rushing noise, which seemed to jar the air around them, and which so many thousands of persons in Southern New Jersey heard with wonder and even with terror.

"Either during the continuance of this noise, or at its close (I do not recollect which my informant stated), he looked at his watch again, and found the time sixteen minutes to ten. He says that the meteor exploded and disappeared before it reached the horizon, and that it had a short train or tail. It disappeared perhaps within ten degrees of the horizon.

"This account is concurred in by his workmen, and coincides with another related by a woodman near Tuckerton, who was in the act of felling a tree, and looking up to see which way it would fall, saw, as he says, 'a large ball of fire' shoot out of the sky, and sink away in the south-west. He was very much frightened, and spoke of it to a gentleman who came up immediately after, who says that three or four minutes elapsed before the terrible roaring began.

"The next week after the phenomenon occurred, I was in the southern part of this State, and as far south as Cape Island; and wherever I went, it was the common subject of conversation. At Tuckahoe and Marshallville on Tuckahoe River, the noise was said to proceed from a cloud of smoke, very high, nearly or quite overhead; while in the middle and lower parts of Cape May County, it was invariably spoken of as being in the north. Several persons in various parts of Cape May County saw the cloud of smoke, but I heard of none who saw the meteor itself."

Mr. Price further says, "I venture the opinion that the meteor came from far beyond our atmosphere, and struck it some distance north-east of the place of its disappearance, passing in a south-west direction towards the earth at an angle of less than forty-five degrees from the perpendicular. If an aerolite, it must have fallen to the earth somewhere in the vicinity or south of Tuckahoe River. I would place its locality somewhere in the forests between Tuckahoe and Maurice Rivers. It is possible that it reached the Delaware Bay in Maurice River Cove, but this I do not think very probable, from the fact that the cloud of smoke seemed nearly or quite vertical at Marshallville."

Again. "The sky was perfectly cloudless, and the wind blowing lightly from the south-west. The noise is variously described, as resembling the quick and *successive* discharges of artillery, the rumbling of a train of cars over a wooden bridge, or the prolonged roar of distant thunder. It continued more than a minute. The noise proceeded from the south-west, and appeared to such as were in the open air, to be above the earth."

Georgetown, Del.

Dr. D. W. Maull says, "Two persons in this vicinity witnessed it, who say it appeared to fall on the ground, not 100 yards from the place where they stood—a noise like the rumbling of the cars on the iron track.—It shook the ground sensibly.—Several minutes, say from four to five, between the flash and report.—The meteor was like a round ball of fire, very brilliant, about the size of one's head, with a tail at least ten feet long, which was quite as bright as the body.—No cloud or smoke observed."

A letter from Baltimore Hundred, in this county, states that, "Several teams were in the road, and the oxen suddenly sprang as though frightened, and the drivers were nearly blinded, and a something was perceived, going through the air, six inches in diameter, with an appendage fifteen feet long, with the forward end a-blaze—all of which settled in a field near by. This was witnessed by a number of people."

Washington, D. C.

J. S. M. writes to the *National Intelligencer*, "Coming in from Georgetown, and being on the north side of the Avenue, very near the western angle of the inclosed space at the intersection of I street, I was startled by the appearance of a meteor of unusual size and brilliancy. Walking eastward, but looking down the Avenue, the vividness of the meteoric light was so intense as to attract my vision from that direction, to the line of I street, immediately over the central part of Senator Gwin's mansion. The meteor itself was a clearly defined object, of a light almost as dazzling as the sun, and of a diameter perhaps three-fourths that of the full moon as seen in the zenith. Surrounding the nucleus of the meteor, was a luminous band of apparently twice its own diameter, and extending vertically 15° to 20°; terminating, however, not in the expanding form of meteoric trains, as generally seen, but in a clear sharp point. Indeed, the whole train of light was singularly well marked against the sky, without nebula or scintillations, excepting that to the northward, and in almost touching proximity to the base of the meteor, there was a companion-ray of light, but of a red color, traveling with it.

"When my eye first caught sight of the object, its base was about 30° from the horizon, and the direction of its track was strictly vertical. It was, perhaps, two seconds in view, for I had time, after seeing it first, to grasp my companion's arm and point to it before it disappeared behind Mr. Gwin's house. My friend had, however, seen it, and his description of it is, that it was like a *huge maul* of fire falling from the sky. The time of observation was precisely twenty minutes past nine, A. M. Without professing scientific lore, it strikes me that the most singular features of this phenomena, were its marvellous brilliancy—so near the sun as it was—and the sharp *artificial* character of its contour."

J. S. L., in the *Union*, says that he was in the open fields, and on high ground affording an uninterrupted horizon, near Glenwood Cemetery, and saw "a meteor falling almost perpendicularly from the heavens. It seemed to fall about four miles from me, in a N. E. direction—ap-

peared to reach the ground. There was a perpendicular line of fire about 100 yards long, with a massive ball of fire at the lower end, about the size of a barrel, and shaped like an inverted balloon."

Prof. Henry says, "I have, myself, verified, on the large map of the city, the direction of the meteor as seen by Mr. Marion Force, one of the assistants in the Smithsonian Institution. He pointed out the precise place on the map where he stood, and the point at which it appeared to descend, and find that the latter bears 4° N. of E. from the former. I have also examined the position of the other observer, J. S. M., on the large map, and find the two observations very nearly agree as to the direction of the disappearance of the meteor; the observation of the latter differing not more than one degree farther north than the former. On questioning Mr. Force particularly as to the perpendicular descent of the meteor, he concludes that it was slightly oblique to the horizon, and apparently descended to the ground, a little north of the foot of the vertical through the point of its first appearance."

A communication, signed "H" in the *National Intelligencer*, referring to the same observation, says, "The meteor first caught the eye of the observer at an elevation of about fifty degrees."

(To be Continued.)

For the Journal of the Franklin Institute.

The Meteorology of Philadelphia.

By James A. Kirkpatrick, A. M.,
Professor of Civil Engineering in the Philadelphia High School.

The importance of a knowledge of the peculiarities of our climate to the physician, the agriculturalist, and the engineer, has long been acknowledged. The physician compares the prevalent diseases of a month with the climatic conditions of the same period, and hopes thereby to obtain a clue to the cause of a disease, or a hint in regard to the means of preventing or counteracting it. The agriculturalist looks over the almanac anxiously, but in vain, to ascertain what kind of weather may be expected at a certain time, so that he may with confidence sow his seed, or refrain for a more favorable opportunity. The engineer and builder learn by close observation of the weather, that a certain period is favorable to the commencement of their operations, which, if neglected, will throw them back perhaps a month or more. So the political economist, taking into view all these circumstances, may draw from them conclusions in regard to time and causes, which may have great influence on the general wealth and health of the community.

In order that a permanent record of the meteorological changes observed may be preserved, I propose, in addition to the general tables furnished by the Committee on Meteorology, to give a general review of the points of interest in each month, and compare the month or season of the current year, with the corresponding month or season of the last year, and of the preceding nine or ten years.

January.—The year 1860 opened with very cold weather, the thermometer, on the morning of the 2d, marking but 3½ degrees above

zero of Fahrenheit's scale. The weather soon moderated, however, and, after a snow storm on the 4th, and a rain storm on the 7th, became remarkably mild. There was a large quantity of floating ice in the Delaware River during the first week of the month, which occasioned some inconvenience to vessels passing up and down; but it had almost entirely disappeared before the middle of the month.

On the 10th, the Schuylkill River was entirely open below the Dam. On the 11th, over half an inch of rain fell; and on the 14th, nearly an inch and a quarter, completely clearing the ice and snow from the streets and rivers.

On the 26th, snow fell, covering the ground to the depth of about an inch and a half; and again on the 31st, to the depth of about seven inches. Both of these deposits, when melted, gave a depth of water of two-thirds of an inch.

The thermometer was lowest on the 2d, and highest on the 21st, when it reached 58°; though the warmest day was the 25th, when the mean temperature was 48·3°.

The barometer was highest on the 5th, when, being reduced to the temperature of 32°, it marked 30·399 inches; and lowest on the 17th, marking 29·593 inches.

There were but two days of the month entirely clear or free from clouds at the hours of observation, and five days on which the sky was entirely covered with clouds.

Comparison of January, 1860 *and* 1859, *with the month of January for nine years.*—The table given below, will exhibit at a glance the difference in the readings of the barometer and thermometer, the direction of the wind, and the quantity of rain which fell in January last; as compared with January of last year, and with the averages of the same month for the nine years from 1852 to 1860, inclusive.

A Comparison of the Principal Meteorological Phenomena of January, 1860, *with those of January,* 1859, *and of the same month for nine years, at Philadelphia.*

	Jan. 1860.	Jan. 1859.	Jan. 9 years.
Thermometer.—Highest, . .	58°	55°	62°
" Lowest, . .	3½	—2	—5½
" Daily oscillation,	14·8	13·0	11·9
" Mean daily range,	6·5	8·0	6·9
" Mean at 7 A. M.,	28·9	30·0	27·2
" " 2 P. M.,	38·4	38·6	35·2
" " 9 "	33·0	33·3	30·8
" " for the month,	33·4	34·0	31·1
Barometer.—Highest, . .	30·399 ins.	30·475	30·704
" Lowest, . . .	29·593	29·387	28·941
" Mean daily range, .	·159	·206	·206
" Mean at 7 A. M., .	29·970	30·016	29·978
" " 2 P. M., .	29·915	29·975	29·940
" " 9 P. M., .	29·938	30·017	29·965
" " for the month,	29·941	30·003	29·961
Rain and melted snow.	3·351 ins.	5·230	2·933
Prevailing winds.	N.89°W.402.	N.80½° W. 375.	N. 65½°W. 340.

For the Journal of the Franklin Institute.

Particulars of the Steamer New London.

Hull built by George Greenman & Co., Mystic, Conn. Machinery by C. H. Delamater, New York. Intended service, New York to New London, Conn.

HULL.—

Length on deck,	145 feet.	
" at deep load line,	135 "	
Breadth of beam, molded,	26 "	
Depth of hold to spar deck,	8 "	6 inches.
Frames—molded, 12 ins.—sided, 8 and 9 ins.—apart at centres, 24 ins.		
Draft of water, forward, 9 feet, aft,	10 "	
Tonnage, 260.		
Area of immersed section at load draft of 10 ft., 224 sq. ft.		
Masts, three. Rig, schooner.		

ENGINE.—Vertical direct.

Diameter of cylinder,		31 inches.
Length of stroke,	2 feet	6 "
Cut-off—one-third.		

BOILER.—One—Return tubular.

Length of boiler,	18 feet.	
Breadth "	8 "	8 inches.
Number of furnaces, 2.		
Breadth "	3 "	3 "
Length of grate bars,	7 "	
Number of flues, above, 16—below, 10.		
Internal diameter of flues, above, . . below, 8 of 9½ ins., 2 of		8 " 16 "
Length of flues, above, 12 ft. 10 ins.—below,	9 "	8 "
Heating surface, 1100 sq. ft.		
Diameter of smoke pipe,	3 "	
Height "	24 "	

PROPELLER.—

Diameter of screw,	9 feet.	
Length "	1 "	6 inches.
Pitch "	17 "	
Number of blades, 4.		

Remarks.—One independent steam, fire, and bilge pump. Poop cabin and deck. Date of trial, October, 1859. C. H. H.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, February 16, 1860.

John C. Cresson, President, in the chair.

John Agnew, Vice-President.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Letters were read from T. Oldham, Esq., Superintendent of the Geological Survey of India, and John B. Murray, City of New York.

Donations to the Library were received from the Royal Astronomical Society, the British Meteorological Society, the Royal Society, the Statistical Society, and the Commissioners of Patents, London; the Royal Irish Academy, Dublin, Ireland; l'Ecole des Mines, Paris, France; Oesterreichischen Ingenieur-Veriens, Wien, Austria; the Governor-General of India, Calcutta, India; L. A. Huguet-Latour,

Montreal, Canada; E. S. Philbrich, Esq., Boston, Massachusetts; the American Institute, City of New York; Wm. E. Morris, Esq., Brooklyn, New York; the Mercantile Library Association, Pittsburgh, Pennsylvania; and from Messrs. H. P. M. Birkinbine, Alfred B. Taylor, Col. J. Ross Snowden, Drs. William P. Moon, Laurence Turnbull, and Professors J. F. Frazer, and J. C. Cresson, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of January, was read.

The Board of Managers & Standing Committees reported their minutes.

Candidates for membership in the Institute (6) were proposed, and the candidates proposed at the last meeting (10) duly elected.

The Standing Committees for the ensuing year were appointed by the President, and approved as follows:—

On the Library.

John Allen,
James H. Cresson,
George Erety,
B. B. Gumpert,
Raper Hoskins,
James T. Lukens,
Samuel Middleton,
Henry K. Plumly,
John S. Sleep,
Laurence Turnbull.

On Cabinet of Models.

Wm. B. Bement,
Joseph Buffington,
George Burnham,
Richard H. Downing,
John Fraser,
Robert H. Gratz,
George C. Howard,
Ephraim L. Pratt,
John L. Perkins,
Coleman Sellers.

On Cabinet of Minerals, &c.

Isaac H. Conrad,
John F. Frazer,
Frederick A. Genth,
Isaac B. Garrigues,
John L. Le Conte,
B. Howard Rand,
Robert E. Rogers,
J. Hamilton Slack,
John C. Trautwine,
Wm. M. Uhler.

On Cab. of Arts & Manuf.

James C. Booth,
Thomas Bickerton,
Samuel Broadbent,
Henry Bowers,
John B. Betts,
Robert C. Cornelius,
Edward P. Eastwick,
David M. Hogan,
Henry J. Taylor,
Henry P. Taylor.

On Exhibitions.

John E. Addicks,
John Agnew,
James H. Bryson,
James H. Cresson,
John M. Gries,
William Harris,
Thomas S. Stewart,
William Sellers,
Isaac S. Williams,
Thomas J. Weygandt.

On Meetings.

Wm. B. Atkinson,
Charles S. Close,
James Dougherty,
Joseph S. Elkinton,
Henry Howson,
Washington Jones,
Thomas E. McNeill,
Andrew Palles,
B. Howard Rand,
John E. Wootten.

On Meteorology.

Chas. J. Allen,
Chas. M. Cresson,
John F. Frazer,
Jas. A. Kirkpatrick,
Alfred L. Kennedy,
J. Aiken Meigs,
Benjamin V. Marsh,
Fairman Rogers,
James S. Whitney,
Thomas J. Weygandt.

Mr. Peirce exhibited and explained the Low-water Detector manufactured by E. H. Ashcroft. It consists of a tube attached to the boiler, just below the water-level, extending vertically to a convenient height, and surmounted by an air-vessel. Just below the air-vessel projects a branch which contains a union-joint arranged to receive a disc of fusible alloy; beyond the disc is a steam-whistle. In the vertical tube is placed a cock, which is intended to prevent the continued escape of steam. The operation of the apparatus is as follows:—

After the boiler has been filled to the water-line, and put in action, the pressure of the steam forces the water up through the instrument into the air-chamber, compressing the air therein and filling this cham-

ber to a greater or less extent, according to the pressure. There being no circulation through the apparatus, so long as the lower end of the tube remains *under* water, its contents will be of a comparatively low temperature, and the disc will remain solid. But whenever the water in the boiler falls *below* the end of the tube, the steam immediately displaces the water in it, and melts the fusible disc, and rushing out through the opening, gives notice through the whistle that the water is falling to a dangerous point. To replace a disc, open the cock cautiously until the water reaches the opening at the top, then shut the cock, and when the water above it has become cool, the disc may be replaced with safety, and the cock fully opened.

The Committee on Meetings placed upon the Exhibition Table, a Model of Fawkes' American Steam Plough, presented to the Institute in accordance with the conditions of the award of the Scott's Legacy Premium. A description by the Committee on Science and Art, was published in the Report made by them, and published in the *Journal.*

No more satisfactory evidence of the superior claims and merits of this invention can be given, than that contained in the reports and awards of the following committees and societies, all of whom witnessed the Plough in practical operation, and subjected it to the most severe tests:—

Franklin Institute of Philadelphia, *Scott Legacy Premium of* $20 *and Medal.*

A Committee of the Pennsylvania State Agricultural Society, *Favorable Report.*

The Philadelphia Society for the Promotion of Agriculture, *Grand Gold Medal and Report.*

Illinois State Agricultural Society, $500 *Premium in* 1858, and $1500 *Premium in* 1859.

United States Agricultural Society, at their Seventh Annual Exhibition at Chicago, *Grand Gold Medal of Honor.*

Illinois Central Railroad Company, $1500 *Premium* and *Report corroborating the above awards.*

American Institute at New York, *Premium of* $1000.

A Committee of Scientific and Practical Machinists, appointed by the Illinois State Agricultural Society, and of the Illinois Central Railroad Company, recommend the award of the Premium of $1500 offered by Illinois R. R. Company.

Also, a working model of Mahlon Reeder's Self-acting Switch for turn-outs of railroads. It is operated by the weight of the car depressing one rail, which inclines upwards sufficiently to give motion during its descent to the switch, by means of rods and levers.

Mr. I. N. Hobbs exhibited and explained a working model of an elevator for Hotels, styled a Steam Reciprocating Stairway Two platforms are arranged to rise and fall by means of screws worked by belts from one landing to the next, pausing at each long enough, say ten seconds, until the passengers can step from one to the other. The edges of the platforms upon the open or entering side, as well as that of the landing, are hinged to prevent any part of the person being caught between them.

Abstract of Meteorological Observations for December, 1859; made in Philadelphia, Adams, and Somerset Counties,

Abstract of Meteorological Observations for December, 1859; made in Philadelphia, Adams, and Somerset Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

PHILADELPHIA.—Lat. 39° 57′ 28″ N. Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. KIRKPATRICK, Observer.

1859. Dec.	Barometer. Mean.	Barometer. Mean daily range.	Thermometer. Mean.	Thermometer. Daily oscillation.	Thermometer. Mean daily range.	Force of vapor. 2 P.M.	Relative humidity. 2 P.M.	Rain and Snow.	Prevail'g winds.
	Inch.	Inch.	°	°	°	Inch.	Per ct.	Inches.	Direc.
1	29·852	·080	57·7	24	8·0	·380	55		S W.
☽ 2	29·812	·040	62 8	17	5·2	·551	75		S W.
3	30·261	·449	32·8	23	30·0	·120	61	0·475	N E.
4	30·076	·185	34·2	11	2·7	·193	95		N E.
5	30·146	·070	36·8	7	2·7	.207	90	0·007	N E.
6	30·031	·115	46·0	15	9.2	·323	93	0·128	N E.
7	29·701	·330	53·3	30	16·0	·510	88	0·464	(var.)
8	30·064	·363	24·5	14	28·8	·089	63		N W.
○ 9	30·129	·182	25·3	14	5·2	·089	55		S W.
10	30·057	·135	26·3	10	5·7	·074	48		N W.
11	29·869	·191	30 0	17	7·7	·129	61		S W.
12	29·715	·228	30·7	12	6·0	·149	70		(var.)
13	30·096	·380	27·5	13	6 5	·106	62		N E.
14	29·915	·180	30·3	7	3·2	·139	83	0·046	N E.
15	30·017	·121	30·7	11	2·3	·129	66		N W.
☾ 16	30·101	·085	29·5	13	3·5	·127	62		N N E.
17	29 809	·292	36·3	15	6 8	·188	85	1 305	N E.
18	29·684	·195	42·3	7	6·7	·216	72		S W.
19	29·816	·131	40·8	13	2·8	·166	52		S W.
20	29·540	·276	40·0	8	3·2	·244	91	0·450	(var.)
21	29·805	·282	33·3	13	6·7	·116	55		W.
22	29·906	·160	26·7	10	6·7	·112	67		W N W
23	29·813	·092	25·7	9	1·0	·112	67		W.
● 24	29·898	·089	29·5	10	5·2	·079	66		W.
25	29·892	·142	26·7	17	7·5	·112	67		S W.
26	29·671	·221	42·3	22	15·7	·172	46		S W.
27	30·065	·394	31·7	20	10·7	·106	50		N W.
28	30·188	·123	13·3	16	18·3	·074	91	0·020	N E.
29	30·035	·153	13·7	9	3·0	·065	81	0·565	N E.
30	29·766	·288	29·2	18	15·5	·149	84		(var.)
31	29·967	·201	22·2	15	7·0	·071	55		(var.)
Means	29·926	·199	33·0	14	8·4	·171	69½	3·460	N 38° W.

GETTYSBURG, Adams Co. Lat. 39° 49′ N. Long. 77° 18′ W. Height 624 feet. Prof. M. JACOBS, Obs.

Barometer. Mean.	Barometer. Mean daily range.	Thermom. Mean.	Thermom. Mean daily range.	Rain and Snow.	Prevail'g. winds.
Inch.	Inch.	°	°	Inch.	Direc.
29·414	·139	51·7	14·0		S W.
29·418	·029	60·3	8·7		S S W.
29·933	·515	27·7	32·7	1·178	N N E.
29·720	·213	32·0	5·0		N E.
29·791	·071	33·7	1·7		N E.
29·643	·148	36·3	2·7	0·375	N E.
29·387	·256	34·7	9·7		(var.)
29·765	·378	16·0	18·7		N W.
29·742	·182	18·7	5·3		S W.
29·703	·153	24·5	5·8		(var.)
29·437	·267	30·0	5·5		S W.
29·293	·220	30·3	6·3		(var.)
29·710	·417	25·7	6·7		N E.
29·578	·132	27·3	1·7	0·028	N N E.
29·656	·101	26 0	3·3		N W.
29·706	·076	25·0	5·7		S.
29·256	·451	32·0	7·0	0 830	N N E.
29·223	·214	36·7	4·3		S S W.
29·421	·198	37 3	4 3		S W.
29·184	·238	34·3	5·0	0·455	(var.)
29·446	·262	28·0	6·3		N W.
29·466	·128	21·7	6 3		S.
29·407	·060	17·7	4·0		(var)
29·542	·135	15·0	2·7		N W.
29·409	·182	21·3	9 0		S S W.
29·257	·226	39·7	18·3		S S W.
29·691	·434	30·3	9·3		(var.)
29·773	·082	15·3	15·0	0·660	N E.
29·609	·176	10·5	4·8		N E.
29·368	·267	22·0	11·5		S W.
29·615	·247	17·0	7·3		W N W
29·536	·213	28·3	8·0	3·526	N 57° W.

SOMERSET, Somerset Co. Lat. 40° N. Long. 79° 3′ W. Height 2195 feet. GEO. MOWRY, Observer.

Barometer. Mean.	Barometer. Mean daily range.	Thermom. Mean.	Thermom. Mean daily range.	Force of vapor. 2 P.M.	Relative humidity. 2 P.M.	Rain and Snow.	Prevail'g winds.
Inch.	Inch.	°	°	Inch.	Per ct.	Inch.	Direc.
27·602	·055	61·3	10·0	·462	65	0·545	W S W.
27·647	·066	54·7	6·7	·475	69		(var.)
27·898	·252	27·0	27·7	·167	100	1·100	W N W
27·722	·177	38·7	11·7	·255	81		E.
27·781	·069	40·3	2·3	·297	85		S.
27·650	·122	42 3	6·7	·244	91	0·361	S.
27·575	·129	24·7	17·7	·110	86	0·048	W.
27·804	·229	11·3	13·3	·063	67		W N W
27 816	·146	19·3	10·7	·134	87		W.
27·800	·105	18·0	7·3	·104	79		(var.)
27·560	·240	29·7	11·7	176	85		W.
27·388	·191	23·7	11·3	·105	85		W.
27·650	·262	22·3	6·7	·116	80		S E.
27·624	·026	27·0	4·7	·168	89		W.
27·699	·075	25·0	2·0	·147	78		W.
27·686	·024	26·7	7·7	·170	80		(var.)
27·274	·412	33·3	7·3	·204	100	0·670	E.
27·317	·178	31·7	3·7	·181	100	0·037	W S W.
27·498	·181	31·3	1 7	·155	79		(var.)
27·227	·271	30·0	2·0	·161	89	0·430	(var.)
27·521	·295	19·0	11·0	·085	72	0·155	W.
27 498	·102	18·0	5·0	·104	79		W S W.
27·457	·050	15·7	3·7	·105	85		W.
27·576	·120	10·3	5·3	·059	66		W.
27·489	·159	29·3	19·0	·143	66		S W.
27·408	·195	40·7	14·0	·298	92		W.
27·733	·325	29·3	11·3	·186	81		W N W
27·672	·061	20·0	9·3	·110	86	0·270	E.
27·471	·201	18·3	9·7	·074	83	0·286	S S E.
27·475	·166	27·3	12·3	·140	88		W.
27·653	·178	8·0	19·3	·061	73		W.
27·580	·163	27·5	9·4	·170	82	3·902	S 73° W.